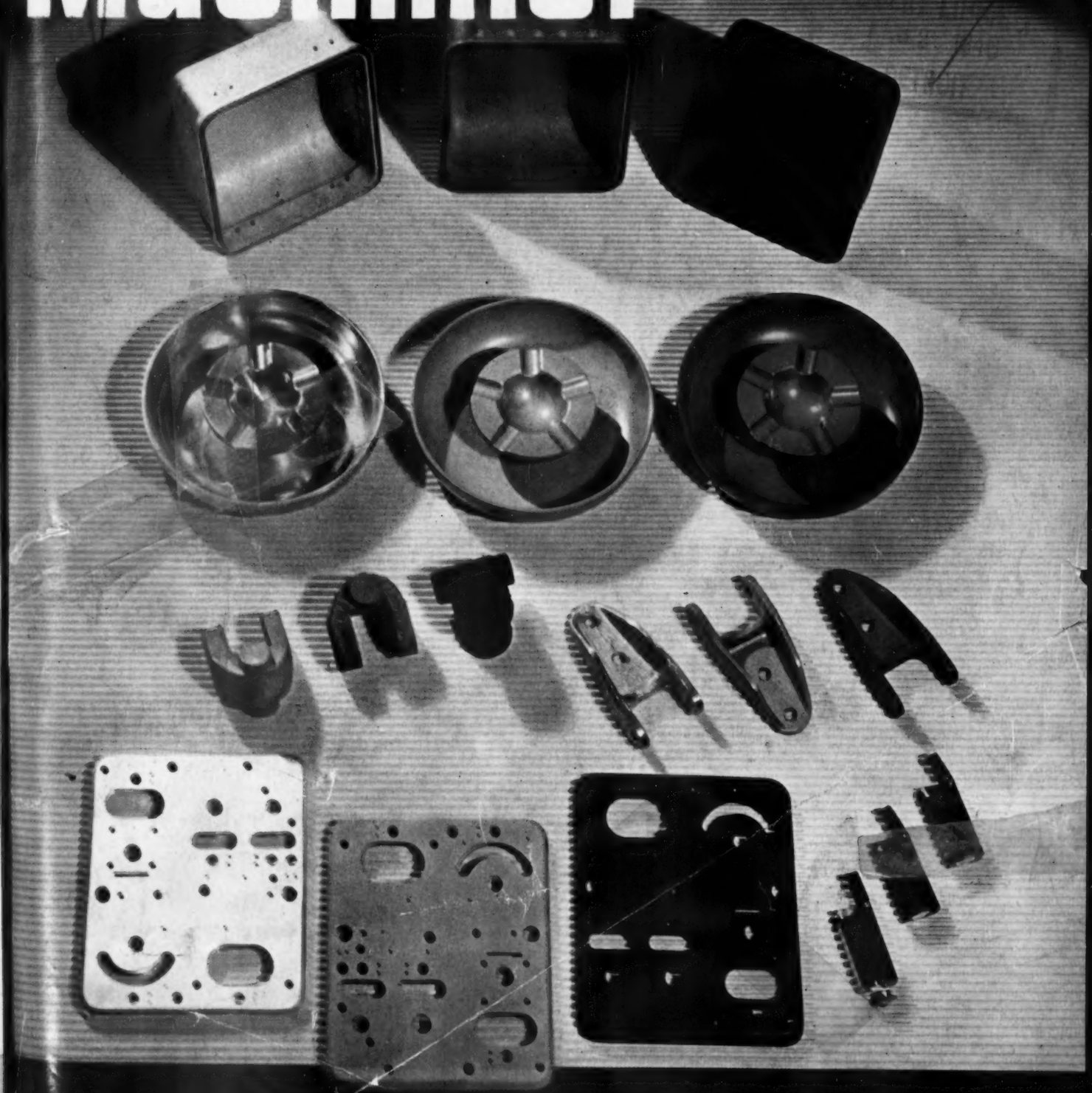
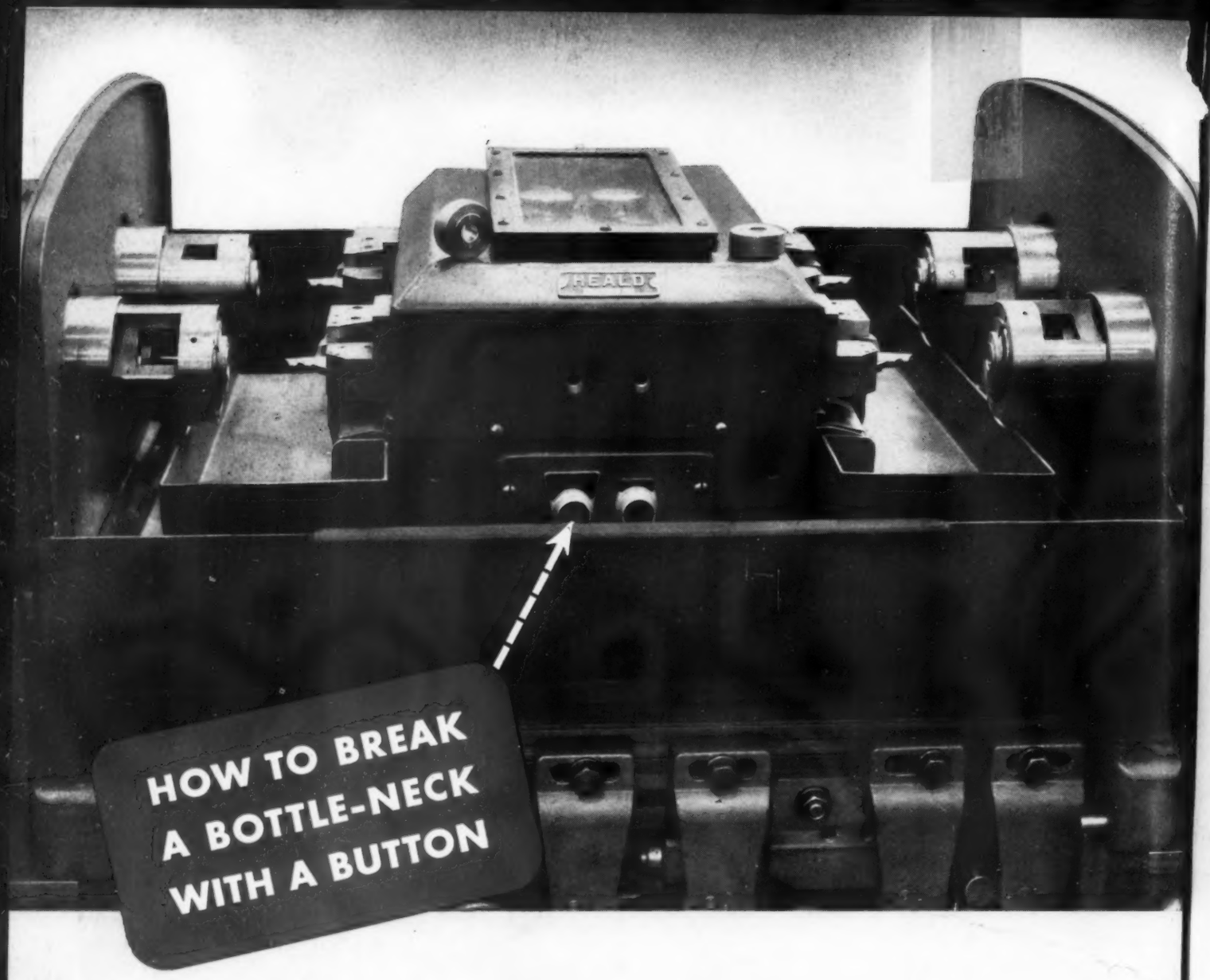
American Machinist

JANUARY 31, 1946



Featuring Metal Processing for Peacetime Products



HOW TO BREAK A BOTTLE-NECK WITH A BUTTON

You can't always control production slowdowns—but anytime you can eliminate six or seven manual operations, and replace them all with a single push-button control, your production line is going to move faster, your costs are coming down. And that's precisely what the Heald Bore-Matic is engineered to do.

In turning out work requiring the most complex multiple operations, control of the Heald Bore-Matic is simplicity itself. For here, at the mere push of a button or the turn of a lever, the operator starts a cycle that can be *completely automatic* from initial cut to final size. What this offers you in faster production, reduced operator fatigue, less scrap and more over-all efficiency can well mean the difference between profit and loss in these days when production costs must be shaved at every turn.

In the illustration above, we have shown the Heald No. 49 Bore-Matic as used on a transmission pinion gear which is bored, faced and chamfered in one automatic cycle—two pinions being finished in one end of the machine and two others at the opposite end.

Bore-Matic cycles can be engineered to meet your own particular requirements for either simple or complex operations, in any combination including boring, turning, facing, grooving, milling, chamfering. Automatic functions (except for loading) may include rapid in-traverse, feeds, speeds, back boring, tool retraction, runout and control table operation as well as cross slides, cross-feed units, auxiliary slides, spherical attachments. Cycles are usually interlocked and hence foolproof.

Heald Bore-Matics are also available with manual control, but it's the push-button cycle that pays off in top production at minimum cost. Our engineers will gladly submit suggestions on how your production can be improved with the Heald Bore-Matic. Write today for further details.

THE HEALD MACHINE COMPANY
WORCESTER 6, MASS.

HEALD

means finer precision
. . . lower costs

INTERNAL AND SURFACE GRINDING MACHINES · BORE-MATIC PRECISION FINISHING MA

American Machinist

January 31, 1946

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American Machinist Chips

Cover Picture . . . One of the newest arts in metal finishing is the production of anodic finishes and dyed anodic finishes upon magnesium. *American Machinist* expresses its appreciation to the Hanson-Van Winkle-Munning Company, Matawan, N. J., for supplying sample parts in three states: "natural" or as received, anodized by the Manodyz process, and anodized and dyed. Part identifications are as follows:

Top row—Hand generator case made by Brooks & Perkins, Detroit, FS-1 alloy
Second row—Ash tray produced by Revere Copper & Brass, Inc., J-1 alloy
Third Row—Two groups of sand castings supplied by Consolidated Vultee in H alloy and C alloy, respectively.
Fourth Row—Radar case cover fabricated by Brooks & Perkins, M alloy.

For industrial parts, the anodized finish will probably suffice; for decorative parts the dyed samples illustrate the effects that can be achieved by impregnating the anodic films with some of the solid-color dyes available.

Special Note: The cover of our previous issue, Jan. 17, featured a striking Kodachrome through the courtesy of Consolidated Vultee Aircraft Corp. It showed the loading of aircraft parts for shipment at the Fort Worth, Texas plant.

No Thanks . . . One of the topics discussed at a recent meeting of the American Petroleum Institute was the future of the industry as influenced by atomic discoveries. This caught our eye:

"Few of us will live to drive atomic automobiles or fly jet planes powered by nuclear energy."

We'd hate to be called a sissy but this prophecy is okay with us.

Family Party . . . W. C. Dillon & Co., Inc., of Chicago, boast a father and 6 sons all as active executives in the firm. The company, manufacturing precision instruments for weighing, measuring and testing, combines about 180 years of engineering and business experience in this one family in the same line.

Jack Frost Rides . . . New products for new plant capacity! An ice-maker called the "Icecuber", said to be capable of delivering 40 cubes every 25 seconds (and refreezing cubes in 30 minutes) is being developed for marketing by Panelectric Products, Division of General Aircraft Equpiment. A commercial model and combination ice-maker and home-freezer food unit are also in the works.

New Year's Note . . . *The New York Sun* recently carried the following gem:

"It all depends on the point of view. A year-end survey of business reports: With America's young men home from the wars and the rationing of cheese abolished, this will be deemed a year of prosperity and pleasure."

Buying Surplus? . . . In case you haven't seen it, the U. S. Maritime Commission publishes monthly a booklet listing marine materials which have been declared surplus by various government agents for disposal by the Maritime Commission. All items listed are available for immediate sale and no 30-day priority waiting period is required.

The address of the Commission is Washington 25, D. C.

Tools of Our Trade . . . Some things just seem to go on forever . . . and a good example is *American Machinist's* now-famous series "The Tools of Our Trade." Published several years ago as fundamental data for the guidance of unskilled shop employees, these reprints keep pulling requests and comments.

A wire was received a short time ago from Harvard Graduate School of Business which included the following: "We are proceeding to make use of certain illustrations in your Tools of Our Trade series. We greatly appreciate this kind help. The material is urgently needed for teaching production, engineering, equipment purchase and plant layout to our graduate students."

Like Ol' Man River, this *American Machinist* editorial feature "just keeps rolling along." Incidentally, we still have on hand a limited number of reprints.

Bosses Beat "Flu" . . . A tough combination of labor shortage, "flu" epidemic and pre-holiday flood of orders recently faced the management of Buckeye Aluminum Company of Wooster, Ohio. Nothing daunted, everyone in the front office—from the president on down—took off his coat, rolled up sleeves and proceeded to get busy. Officials organized their own night shift and pitched in to pack and ship the utensils that were piling up.

The view here shows (left to right) Ward Butterfield, Sales Manager, Ross Shoolroy, President, and William Braund, Purchasing Agent.

Editors Take a Bow . . . The latest comment on *American Machinist's* 1945 Inventory of Production Equipment (December 6 issue) comes from the United States Tariff Commission. Quoting the Chief of their Metals Division: "It is a swell job and we will have much use for it."

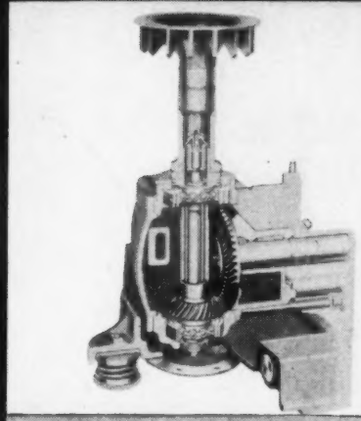
FOR
LIGHT OR HEAVY LOADS
USE BEVEL GEARS

Wherever a power transmission problem arises, bevel gears can be designed to provide unfailing operation for all load requirements.

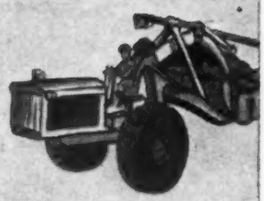
INDUSTRY

Bevel gears have constantly proven their capacity to handle the heavy loads so frequently found in industry. The cement pulverizer illustrated above is just one of the many examples.

HOME



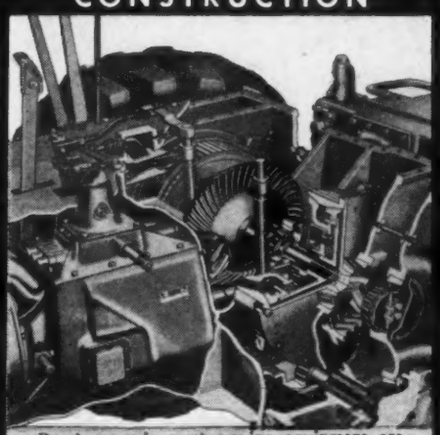
The same dependability required in heavy load applications is obtained in these small bevel gears designed to give quiet, reliable service in home oil burners.



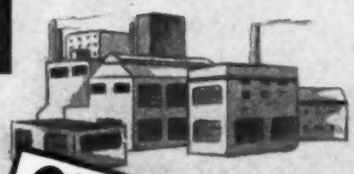
TRANSPORTATION

This planetary angular bevel gear unit transmits, without failure, a steady flow of power to the propellors pulling our airliners through the air in all kinds of weather.

CONSTRUCTION



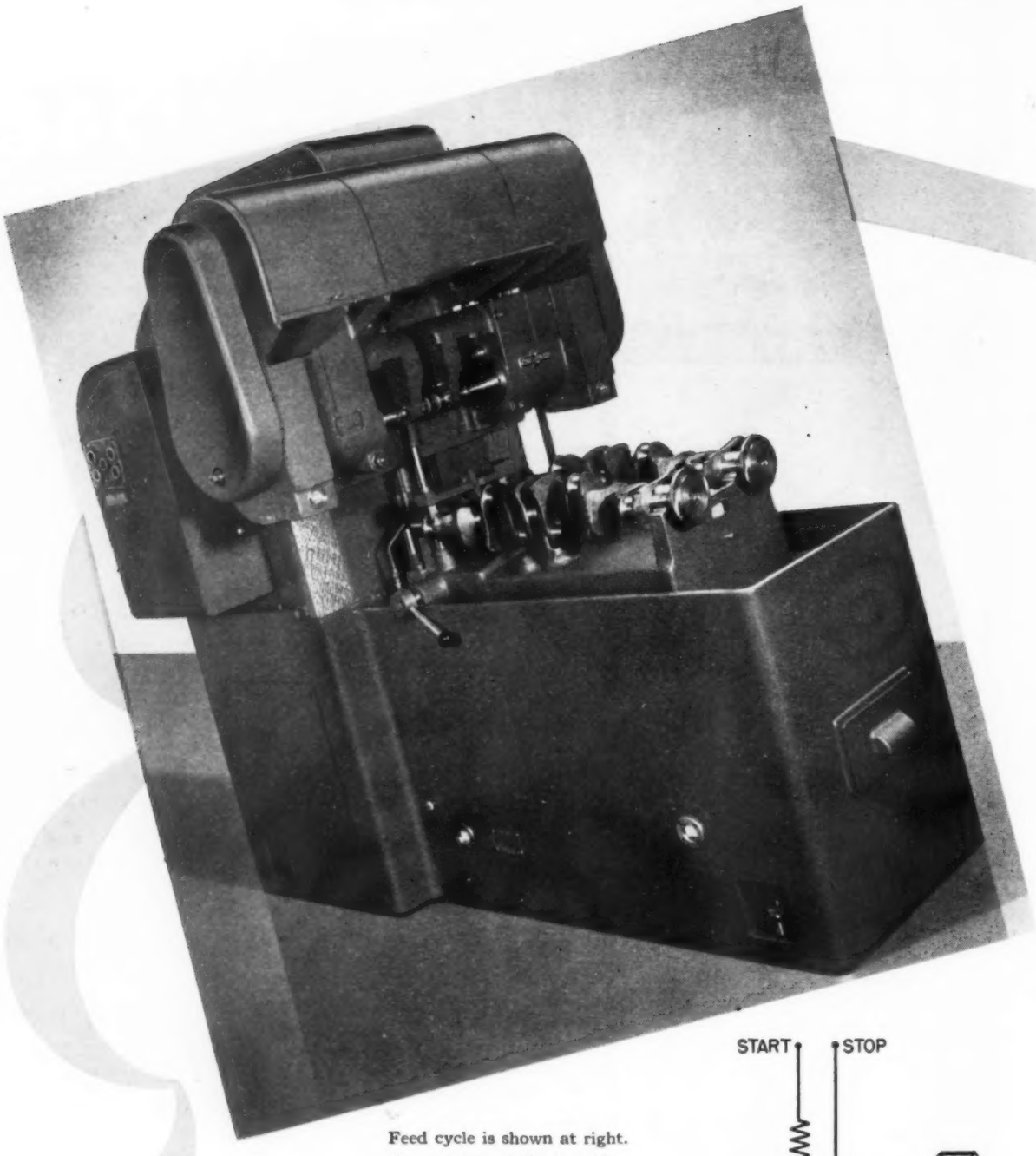
Bevel gears in earth-moving equipment are used to provide the durable power transmission necessary to make possible the movement of heavy loads over rough terrain and steep inclines, forging new and finer highways of travel.

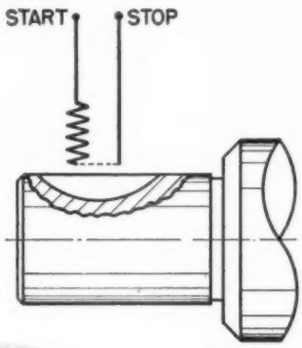


These are only a few of the instances where Gleason engineers have assisted in the design of the right bevel gear for the job. Perhaps we can help you. Send in prints, and our engineers will study them, suggest improvements and recommend the correct gear cutting equipment.

GLEASON Works
Builders of BEVEL GEAR MACHINERY FOR OVER EIGHTY YEARS

1000 UNIVERSITY AVENUE
ROCHESTER 3, NEW YORK





Feed cycle is shown at right.
Name of part: Crankshaft
Operation: Mill Woodruff Keyway
Material: Nickel Steel Forging
Production: 130 per hour
Machine: Special CINCINNATI Automatic Rise and Fall Miller.

THE CINCINNATI

MILLING MACHINES

PRODUCTION TIME CUT FROM MINUTES TO SECONDS

Woodruff keyways are milled in 130 crankshafts every hour with this setup. It's a special CINCINNATI Rise and Fall Miller, designed for handling this job. ¶ So that the cutters would not interfere with, or be damaged by loading and unloading operations, the machine was built with a vertical traverse range to the spindle carriers of more than 10 inches. The setup includes a special feed cam to reduce feed rate as the cutter progresses into the work, and a simple hand-clamping fixture for holding two parts. ¶ The equipment illustrated reduced production time from minutes to seconds, and is typical of Cincinnati Engineering Service. Talk over your milling operations with our engineers. Any number of manufacturers have found it profitable to do so.

CINCINNATI

MILLING MACHINE CO. CINCINNATI 9, OHIO, U. S. A.

BROACHING MACHINES • CUTTER SHARPENING MACHINES

WHEN PURCHASING EQUIPMENT FOR MEASUREMENT AND INSPECTION BY OPTICAL PROJECTION, YOU SHOULD DEMAND:

1. Precision Condensing Lens System for controlling light.

2. Projection lenses that project a sharply defined image, free from distortion and color, *anywhere on the screen.*

3. Optically Flat Reflection Mirrors *sufficiently thick* to insure *permanent* flatness.

4. Provision for positively aligning the illuminating system, staging fixtures, projection lens, mirror and screen in correct relation to each other.

5. Rigid Machine Construction.

Beyond a SHADOW of a doubt

Probably a Jones & Lamson Optical Comparator could effect comparable savings for you. Write for our book, "Beyond a Shadow of a Doubt." Or, better still, ask for one of our inspection engineers to call and discuss your inspection problems.

DID YOU KNOW...
THAT MUSICAL INSTRUMENT PARTS SUCH AS ADJUSTABLE PIVOT SCREWS, MOUTHPIECES, MOUTHPIPES AND OTHER CRITICAL PARTS ARE INSPECTED ON JONES & LAMSON OPTICAL COMPARATORS.

QUALITY CONTROL

Quality control at the source may spell the difference between profits and failure in the intense competition that lies ahead. Manufacturers may use the most efficient production methods possible but lose all the advantages by inadequate inspection facilities.

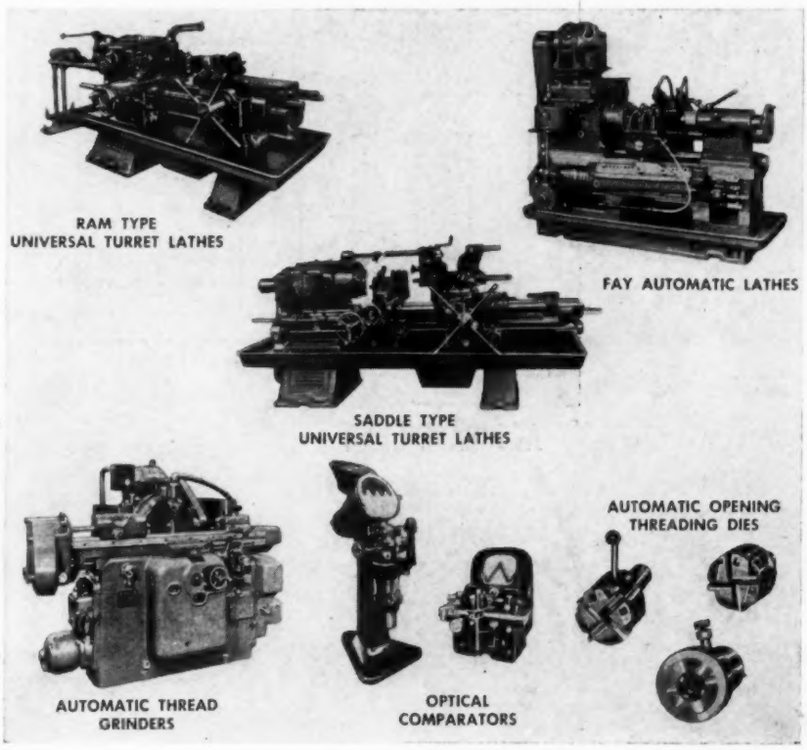
Jones & Lamson Optical Comparators provide a simple, rapid and extremely accurate means of determining the accuracy of tools and the quality of products. Numerous models are available for the inspection of an almost unlimited range of gages, tools and products.

Our engineers are inspection specialists, their knowledge of holding fixtures, handling methods and suitable Comparator equipment has saved thousands of dollars in manufacturing plants throughout the country. Call, write or wire for their service today.

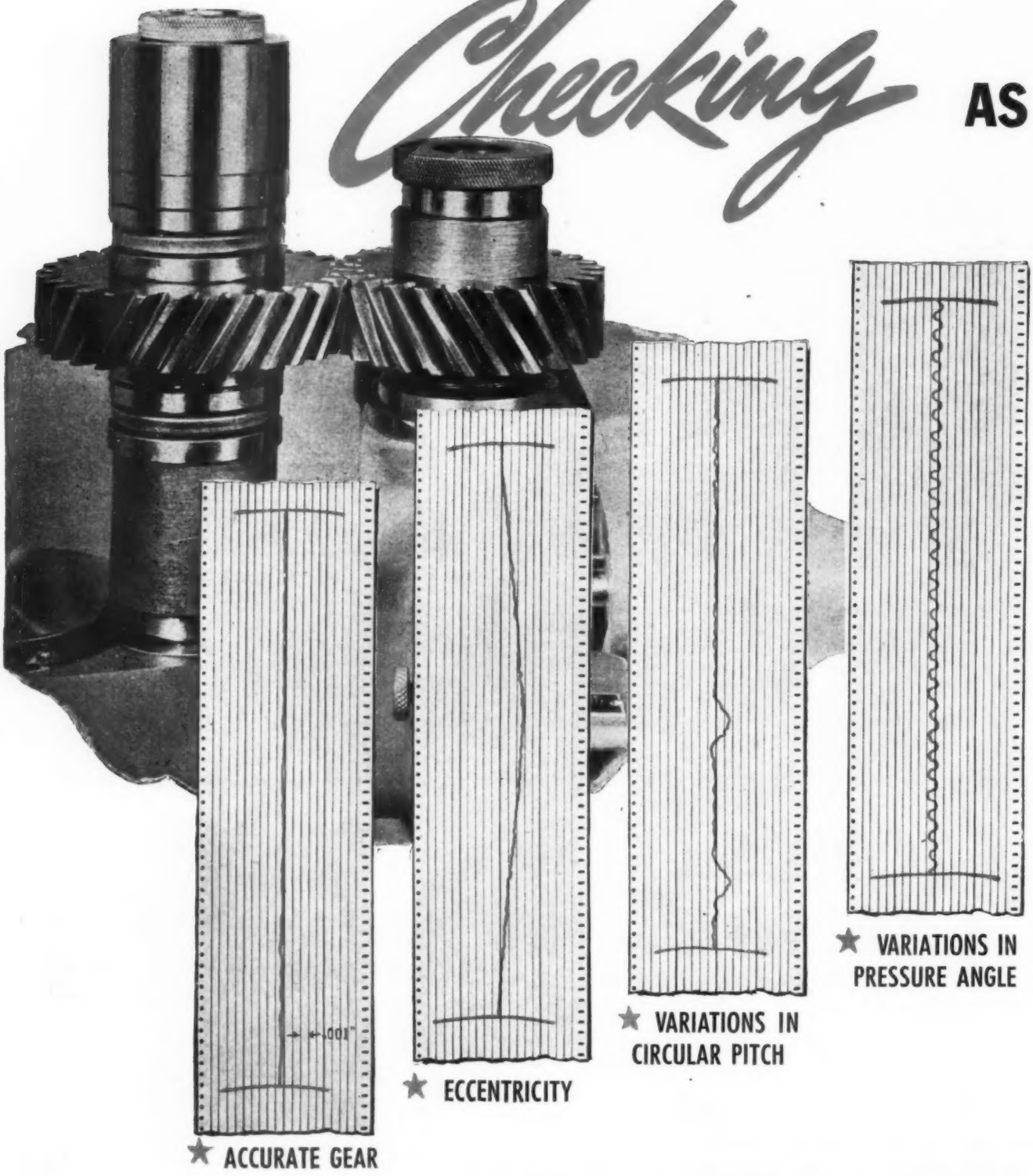
JONES & LAMSON
MACHINE COMPANY
SPRINGFIELD, VERMONT, U. S. A.

OPTICAL COMPARATORS

Manufacturer of: Universal Turret Lathes • Fay Automatic Lathes • Automatic Double-End Milling and Centering Machines • Automatic Thread Grinders • Optical Comparators • Automatic Opening Threading Dies and Chasers.

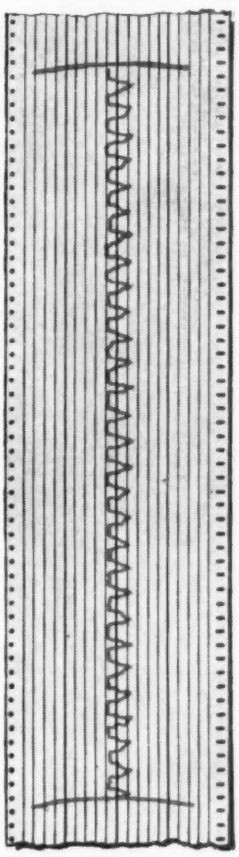


Checking AS

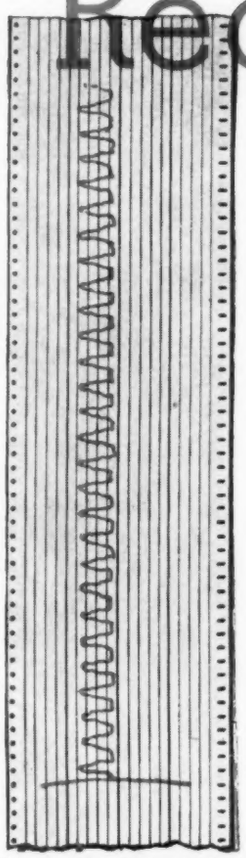


THE FELLOWS METHOD... MACHINES AND TOOLS FOR

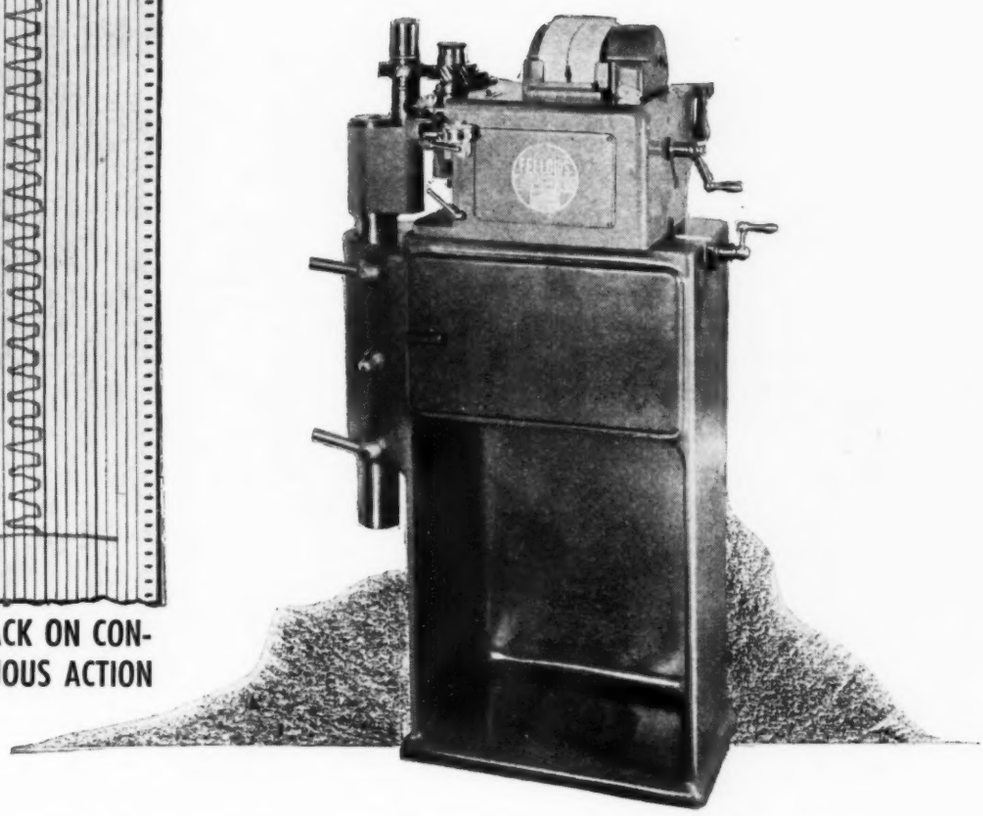
ONLY A Red Liner CAN DO IT...



★ FILLET INTERFERENCE



★ LACK ON CONTINUOUS ACTION

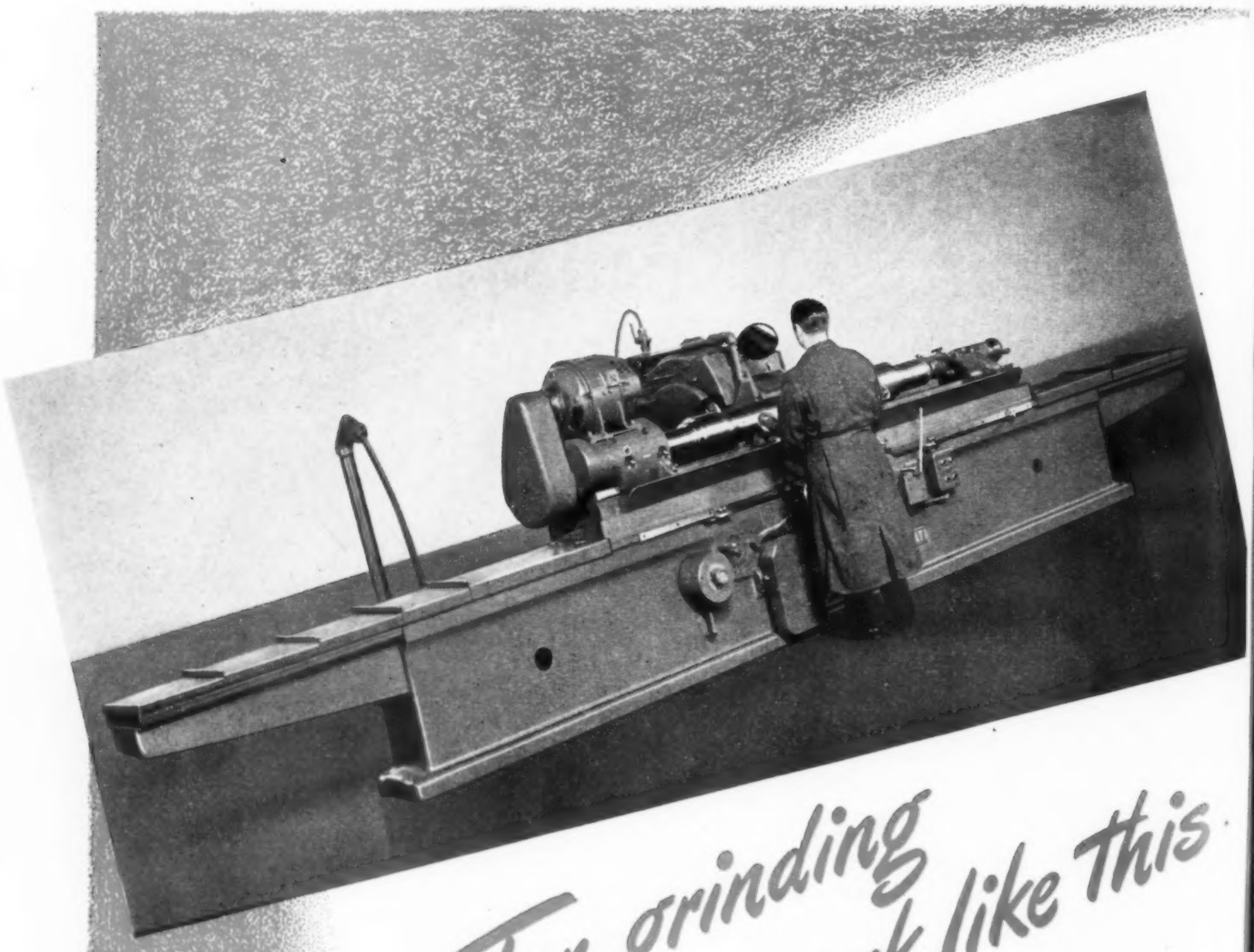


This checking instrument's recording of all errors in combination best serves manufacturing requirements, since it most nearly approaches actual gear operating conditions. Each error produces a characteristic deviation from a straight line. These errors, however, are easily identified and their magnitude and location determined. Ask the Fellows sales engineer, or write for the Red Liner bulletin.

Address: The Fellows Gear Shaper Co., Springfield, Vermont—or 616 Fisher Bldg., Detroit—or 640 West Town Office Bldg., Chicago.

Fellows

ALL OPERATIONS FROM BLANK TO FINISHED GEAR



For grinding heavy work like this

CHOOSE A CINCINNATI SELF-CONTAINED

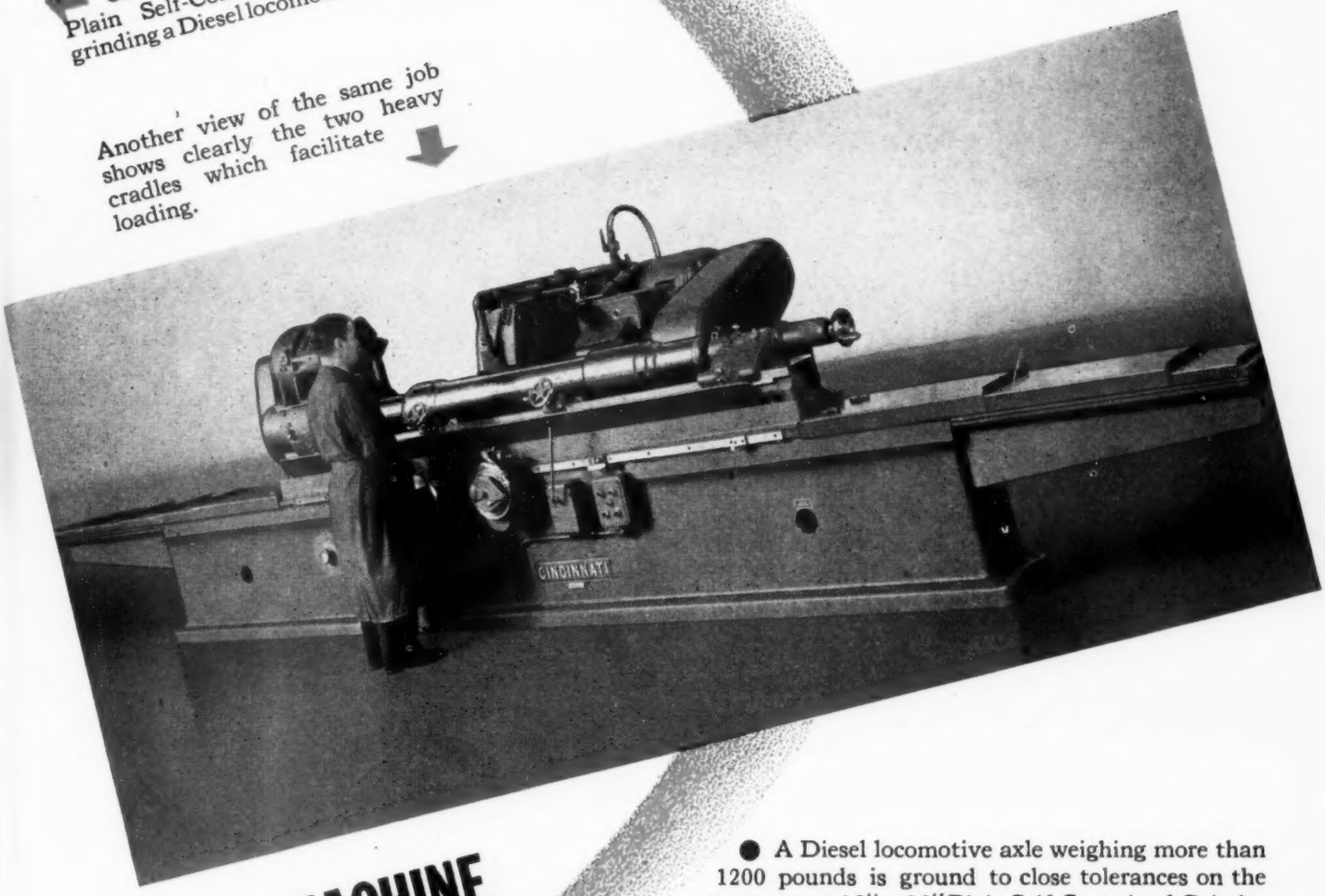
FILMATIC

CINCINNATI

CENTER TYPE GRINDING MACHINES

CINCINNATI 16″ x 96″ Plain Self-Contained Grinder, grinding a Diesel locomotive axle.

Another view of the same job shows clearly the two heavy cradles which facilitate loading.



GRINDING MACHINE

● A Diesel locomotive axle weighing more than 1200 pounds is ground to close tolerances on the CINCINNATI 16″ x 96″ Plain Self-Contained Grinder illustrated here. The machine has a single solid table; variable speed headstock drive; power rapid traverse to wheelhead, and two heavy loading cradles adjustable from the front. ¶ CINCINNATI Plain Self-Contained Grinders are especially desirable for large, heavy, precision work. Their sturdy construction and exclusive **FILMATIC** Spindle Bearings assure rapid metal removal to close accuracy and high quality finishes; unusually low maintenance expense; longer life. Complete specifications on these machines (14″ and 16″ swing sizes; between-center lengths up to 168″) may be obtained by writing for Catalog G-491-2. ¶ Cincinnati Engineering Service is available to work out more economical and productive methods of handling your grinding operations. Talk over your grinding problems with our engineers.

CINCINNATI

GRINDERS INCORPORATED

CINCINNATI 9, OHIO, U. S. A.

CENTERLESS GRINDING MACHINES • CENTERLESS LAPPING MACHINES

An Investment that Reduces Costs

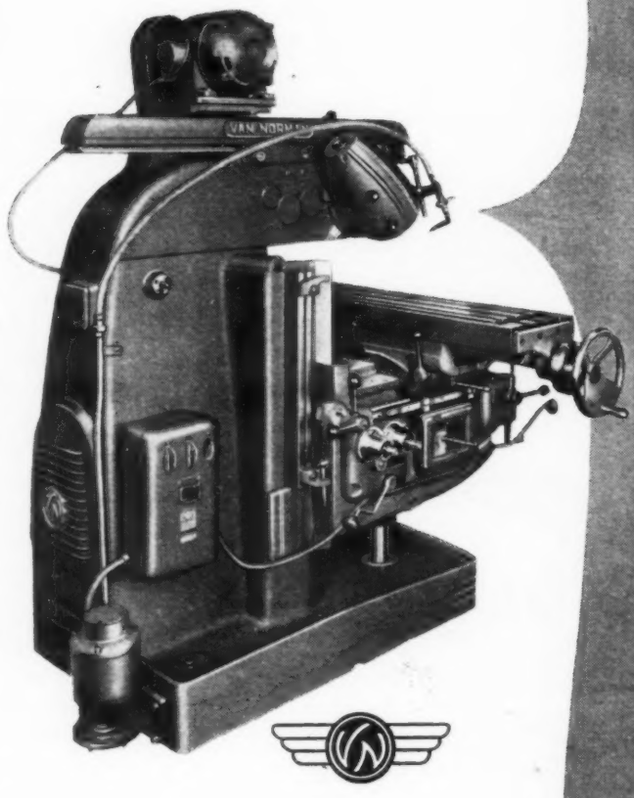
VAN NORMAN
Ram-Type Millers

No matter what your milling requirements . . . horizontal, angular, vertical . . . you can do the job on a *single* Van Norman Ram Type miller. How—simply swivel the adjustable cutterhead to the desired cutting position and you're ready for the operation.

The versatility of ram type millers to perform the work of many single-purpose machines pays off dividends by cutting idle machine and operator time as much as 50% because there is no waiting for specific machines . . . no continual changing of the workpiece. And in those plants where milling operations change from period to period, Van Norman Ram Type millers change to meet the work by swiveling the adjustable cutterhead. All horizontal, angular or vertical . . . some horizontal, some vertical, etc.—those are the combinations you can have with Van Norman Ram Types.

For ease of operation and accuracy of work, Van Norman gives you front and rear control of all power and manual feeds, single-lever feed selector, finger-tip directional control of power feeds, large easy-to-read dials, movable ram . . . each and every feature points to increased production, lower milling costs, wide application of use.

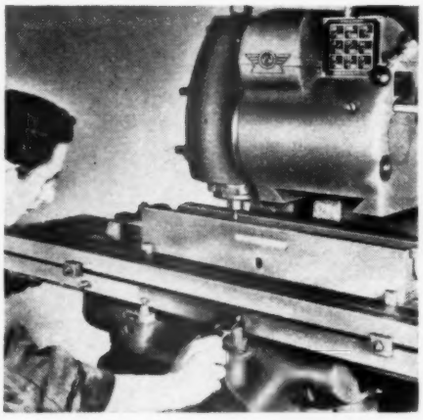
Find out how you can profit with Van Norman Ram Type millers. Write for information, today. They are available in 8 standard models with plain or swiveling tables.



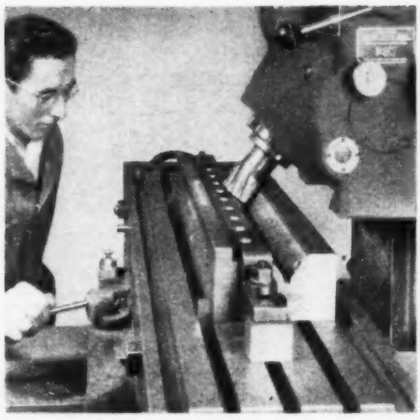
VAN NORMAN COMPANY
SPRINGFIELD 7, MASSACHUSETTS

"It Pays to Van Normanize"

Cuts work reset-ups...improves accuracy



VERTICAL MILLING—With the adjustable cutterhead locked vertical and the workpiece positioned, the operator, using the front controls, starts the operation by milling a recess in the work.

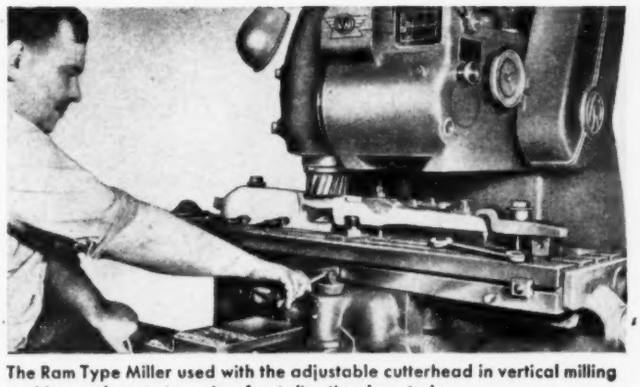


ANGULAR MILLING—Here a "V" is being milled. Note that only the position of the cutterhead has been changed, the workpiece is still in the original position.

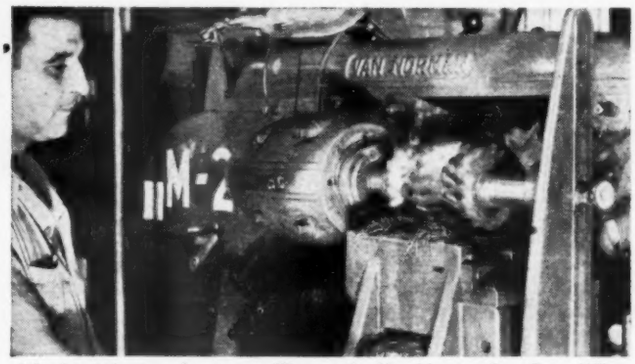
HORIZONTAL MILLING—Using the rear controls the operator completes the job with a face milling operation. One work set-up and simple changes in the versatile cutterhead complete most jobs.

Eliminates idle machine time...increases production

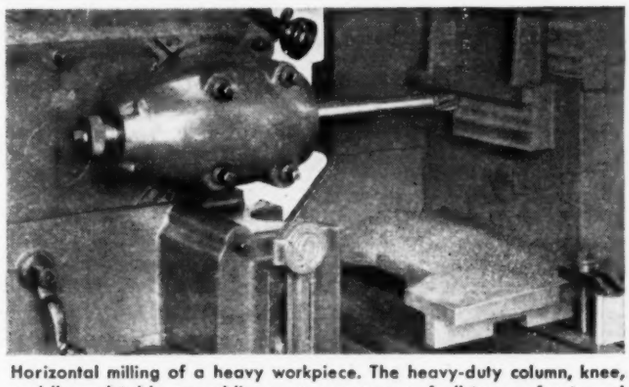
With the head locked in an angular position, the operator is taking an angular cut operating the miller with rear *directional* controls.



The Ram Type Miller used with the adjustable cutterhead in vertical milling position and operator using front *directional* controls.



A horizontal set-up for gang milling on the Van Norman Ram Type Miller. The ram type overarm with dovetail ways and arbor support assure rigidity and accuracy.



Horizontal milling of a heavy workpiece. The heavy-duty column, knee, saddle and table assemblies assure accuracy of all types of cuts and workpieces.

The LANDMACO Threading Machine is a precision tool capable of handling many threading operations much more economically than the heretofore slower and therefore more expensive methods.

It has many new and exclusive features which combine to assure the greatest possible degree of accuracy, ease of operation and flexibility in making set-up changes.

LANDIS MACHINE CO.

THREADING MACHINES • COLLAPSIBLE TAPS • PIPE THREADING MACHINERY

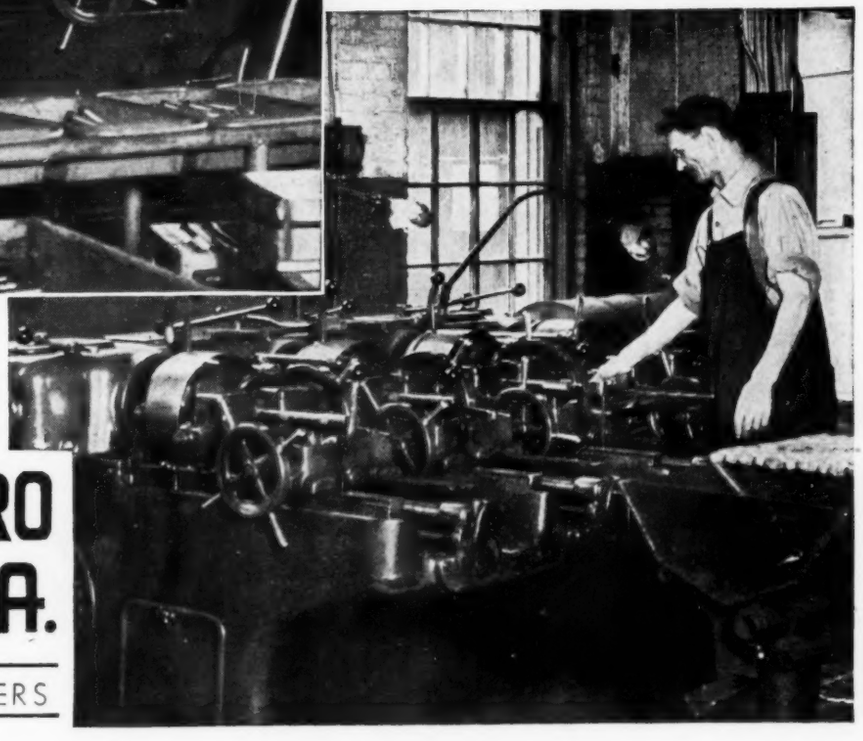
Cost *Still* Counts

THE LANDMACO THREADING MACHINE ASSURES MINIMUM OPERATING COSTS

The Landmaco Threading Machine is the preference in most railroad shops for threading stay-bolts, taper head crown bolts, header bolts, etc.—First, because the machine is easily set up—efficient for short run jobs. Second, it is geared for high threading speeds assuring maximum production. Third, the Landmaco employs the Landis long life Tangential Chaser which reduces tool cost to a minimum by producing more threads per grind and innumerably more threads per set of chasers.

The above facts have been proven in hundreds of installations. May we show you why the Landmaco Threading Machine can be profitably employed on your threading operations.

Write for Bulletin No. H-75



WAYNESBORO PENNA. U.S.A.

DIE HEADS · CHASERS

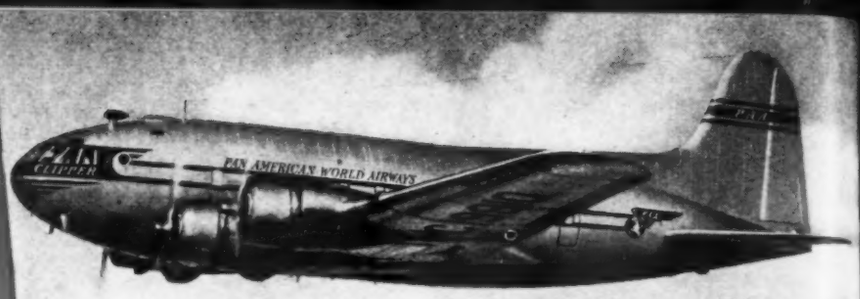
Under the Palms at Miami

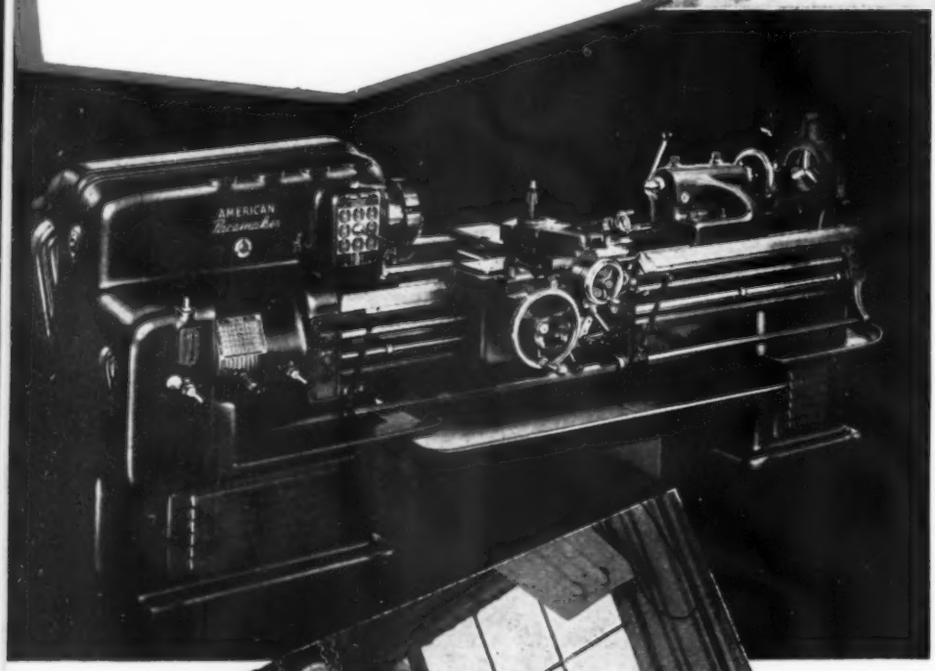
"AMERICAN"

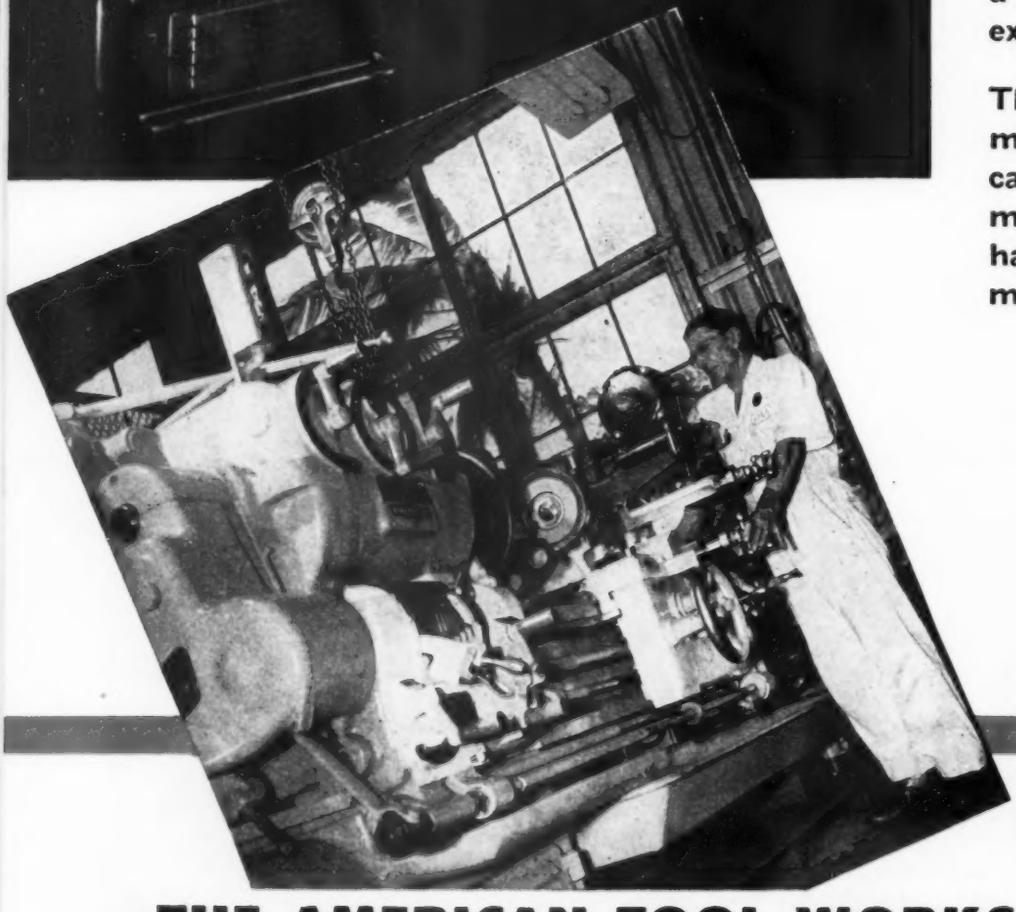
SERVES

PAN AMERICAN

to keep the "Flying Clippers" flying







Before installing their "American" Lathe Pan American World Airways had to send their crankshafts back to the factory for repair. Now they do the job themselves in their own shop at a tremendous saving in time and expense.

This "American" accepts the many miscellaneous jobs it is called upon to do without a murmur. Its power, range, ease of handling and dependability have made it a favorite in this shop.

Bulletin No. 16 gives all the reasons

THE AMERICAN TOOL WORKS CO.

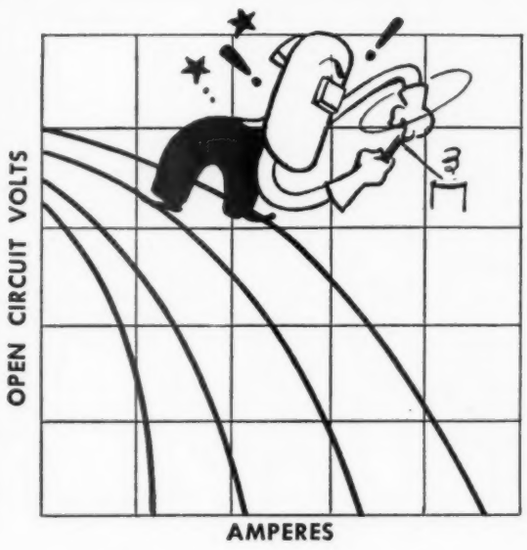
Cincinnati, Ohio, U. S. A.

Lathes and Radial Drills

IT'S FEATURED BY AMPAC!

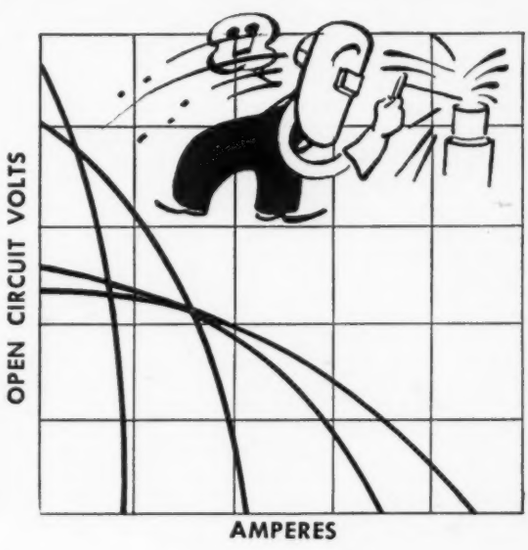
Magic Arc Control

for Automatically Correct, Easy-to-Strike Arc



Conventional a-c welder

It's a well known fact that *low* current welding requires higher arc striking voltage. But high striking voltage for *high* current settings results in costly power waste. Conventional a-c welders—with almost *constant* striking voltage—must compromise between the two . . . or furnish *two-range* control.



Ampac a-c welder

It's *easy* to strike an arc with Ampac a-c welders. Patented circuit *automatically* gives you correct striking voltage every time! You get *high* striking voltage at low amperage settings—*low* striking voltage at high amperage settings. Result: better power factor, greater economy, less welding spatter.

TEST AMPAC FREE — UNDER YOUR CONDITIONS

Call or write our nearby welder dealer, district office or main office for further information or for a trial test of Ampac a-c welders. See for yourself why Ampac rates as the ideal welding unit. ALLIS-CHALMERS, MILWAUKEE 1, WIS. A1936

ALLIS-CHALMERS

HEAR THE BOSTON SYMPHONY: *Every Saturday Evening, American Broadcasting Co.*

ANOTHER LANDIS TOOL *First*

Landis Tool Centerless Thread Grinder complete with built-in wheel crusher. Convenient controls permit adjustments for different sizes of work, rates of feed and position with respect to wheel.

CHECK THESE ADVANTAGES

GREATER PRODUCTION—Reduced work handling and higher speeds have given production per day increases of from *two to five hundred per cent* over other methods.

SMOOTH SURFACE—Threads produced on the Centerless Thread Grinder have the characteristic smooth surface of a ground finish.

BRIGHT FINISH—Threads ground from hardened stock have a distinctive clean, bright appearance and require no further treatment.

GREATER ACCURACY—Warpage and distortion of threads by final heat treatment eliminated because threads are ground from hardened stock.

CLOSER TOLERANCES—Multi-groove grinding wheel assures that all thread forms will be exactly uniform.

LESS INSPECTION—Gaging of each piece is eliminated. Once the machine is set up and in production, only spot inspection is needed to check wheel wear.

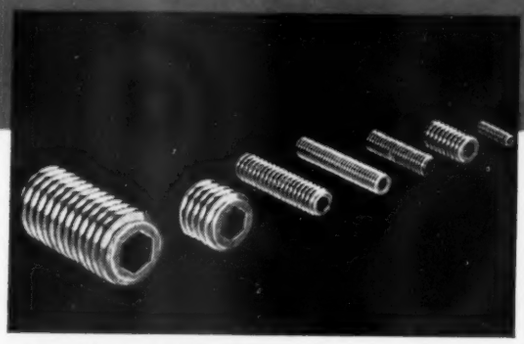
FEWER REJECTS—Elimination of heat treatment distortion together with the accurately formed multi-groove grinding wheel almost entirely eliminates rejects.

LANDIS TOOL *Precision Grinders*

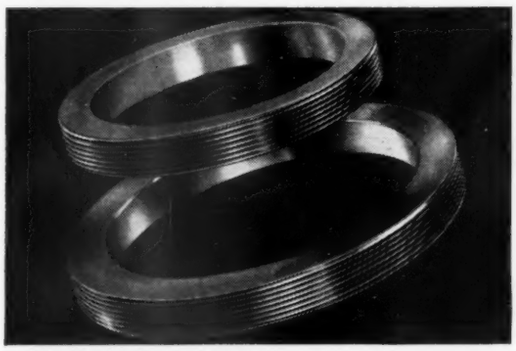
LANDIS TOOL COMPANY

W

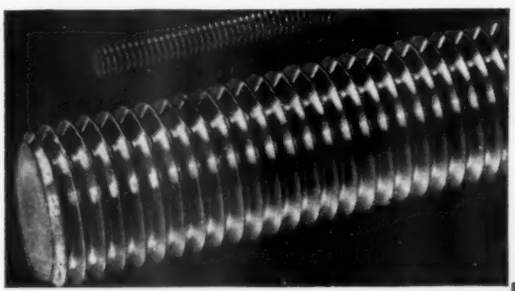
Centerless GROUND THREADS



SOCKET SCREWS—from 1/8" diameter 40 pitch to 5/8" diameter 11 pitch have been ground in production.



THREADED RINGS—hardened steel rings 5" diameter with 16 pitch threads ground in two passes.



LONG SCREWS—12" long 1/4" diameter screws 20 pitch in one pass and 6" long, 1" diameter screws 8 pitch in two passes.

UP TO 500% GREATER PRODUCTION

The new LANDIS TOOL Thread Grinder was developed to meet today's needs for increased production of highly accurate threaded parts. It is another first for LANDIS TOOL in the field of precision thread grinding — introduced *now* to speed production. Application of the Thread Grinder to socket screws has been demonstrated by a year of development and production experience in cooperation with a leading manufacturer.

Our engineering department will be glad to consult with you on any of your thread grinding problems and make recommendations on the possibilities of the Centerless Thread Grinder.

23

LANDIS TOOL *Company*

WAYNESBORO, PENNA.

Snyder Special runs 375 PIECES HOURLY ON 12-OPERATION CYCLE

Performing 12 successive operations upon a brass sprinkler head body, this two-way horizontal machine, designed and built by Snyder, produces 375 parts an hour at 80% efficiency.

The part is a brass casting without previous machining and operations are drilling, reaming, hollow milling and threading on one end, and, hollow milling, facing, drilling and tapping the other end, plus assembling and spinning in place a pressed metal deflector of which there are three sizes and shapes.

The work-piece is loaded manually into a double-jaw screw chuck actuated in loading position by hydraulic cylinders. Six of these fixtures are mounted on a trunnion which is indexed 60° station to station.

Each station has separate slide and spindle motor and each spindle has separate hydraulic control. Hydraulic power for slides and clamping mechanism is supplied by a hydraulic power unit set behind the machine.

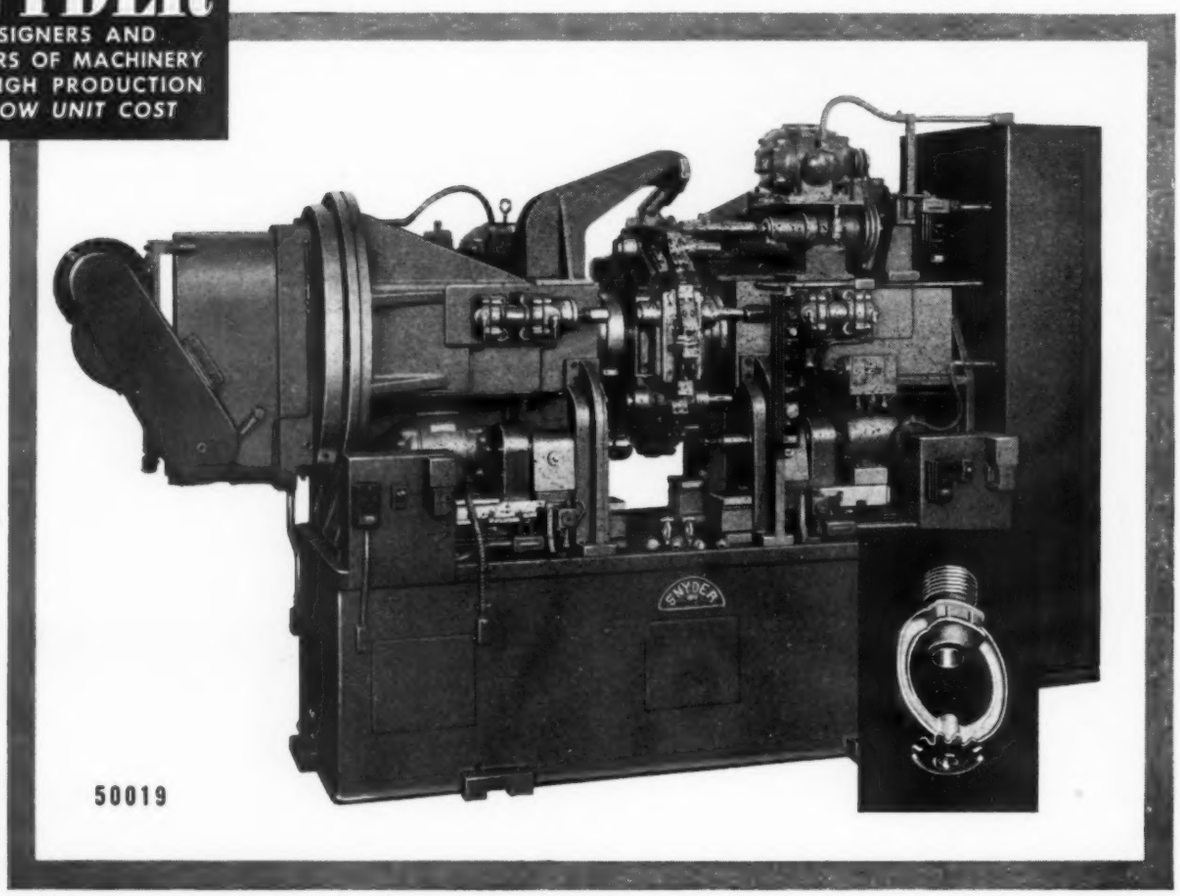
The index mechanism is mounted at the left end of the machines and keyed to the trunnion fixture through a heavy trunnion shaft.

Machine base and trunnion bearing housing are welded steel. Index mechanism housing and hydraulic slide bases are cast iron. Slides are hardened and ground steel. Because operations are on brass, no coolant is provided.

The economies of this type of machine include reduced handling and operator fatigue, accurate control of precision, finish and time cycle, use of unskilled help, increased safety. Is your production department equipped with modern, time-saving, cost-reducing production units? Perhaps Snyder can help you too. *Snyder Tool & Engineering Company, 3400 E. Lafayette Avenue, Detroit 7, Michigan.*

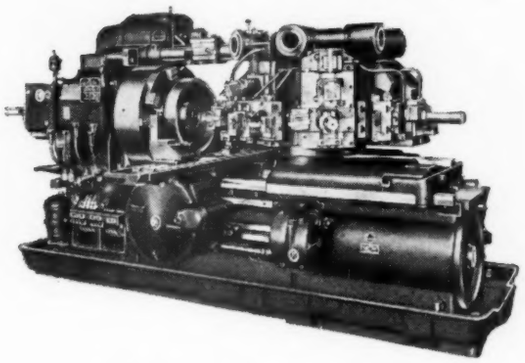
SNYDER
DESIGNERS AND BUILDERS OF MACHINERY FOR HIGH PRODUCTION AT LOW UNIT COST

21 Years of Successful Cooperation with Leading American Industries

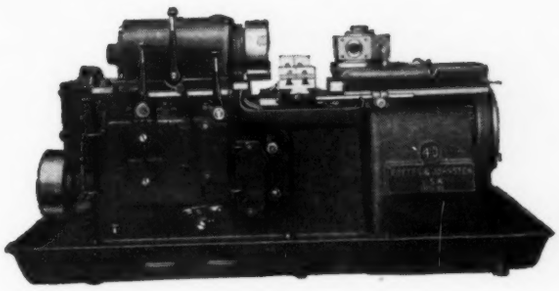


P&J AUTOMATIC CHUCKING and TURNING MACHINES

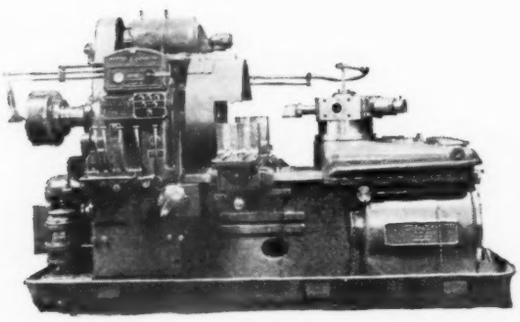
Leaders in their field for more than 40 years



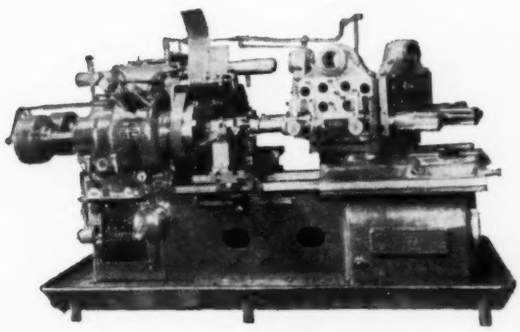
P&J 8DT and 8DXT Automatic



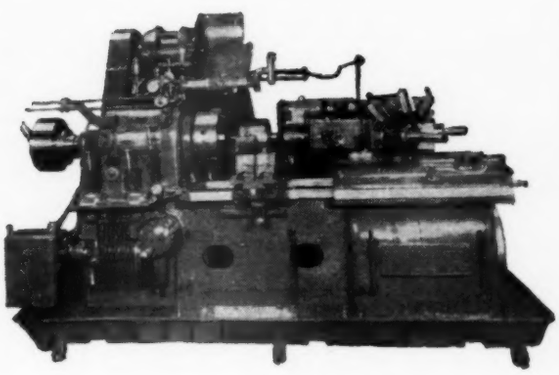
P&J 4D Automatic



P&J 6D REL and 6D REELX Automatic



P&J 5D— Two Spindle Power-Flex Automatic



P&J 5D Power-Flex Automatic

BUY THOSE EXTRA VICTORY BONDS NOW!

The complete line of P&J Manufacturing Automatic Chucking and Turning Machines covers practically all requirements for size range of work. High accuracy, fast work and convenience in handling are assured whether parts produced are small or large. Every machine, regardless of capacity, can be tooled and re-tooled to provide the utmost in flexibility for meeting specific machining requirements.

P&J engineers are available to help you with your production problems. Ask for descriptive literature covering P&J machines.

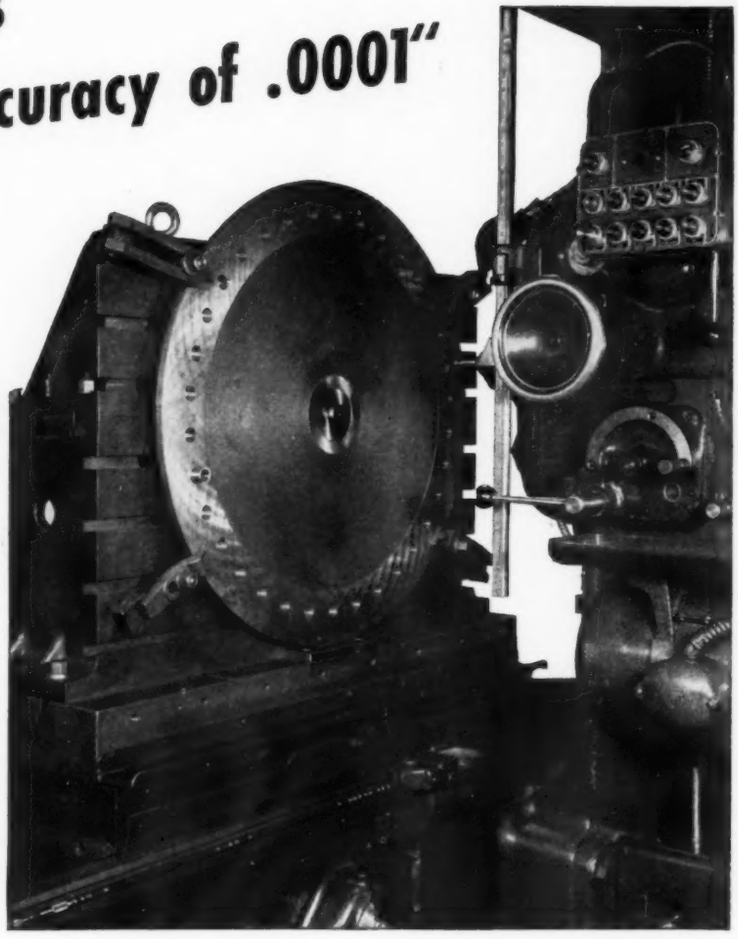
POTTER & JOHNSTON MACHINE COMPANY

Pawtucket, R. I.

34 Index Holes

Bored to Spacing Accuracy of .0001"

in 10½ Hours!



Here's a typical report on the actual results obtained by one manufacturer using the new Model 3-B DeVlieg JIGMIL on a precision boring operation . . .

Part machined was a large index plate . . . 35" in diameter, 1¾" thick . . . of Mehanite casting. Using a Carboloy boring tool, 34, 1¼" index holes were bored to spacing accuracy of .0001" and shoulder depth of 1½" was held to .0002"! Total floor-to-floor time . . . . including set-up . . . was 10½ hours!

For such outstanding performance, speed and precision on your own boring operations, investigate the unusual accuracy and high productivity of the Model 3-B DeVlieg JIGMIL today!

The world's finest Boring and Milling machine!

Write today for complete descriptive folder.

One job well done deserves another

Create More Jobs Faster with a De Vlieg JIGMIL

Here's why users report two to three times the output with greatly increased accuracy as compared to other methods of boring and milling . . .

Centralized push button controls provide fool-proof precision for all functions of the machine. Automatic positioning of spindle from one location to another is controlled to within less than .0001" . . . and feather-touch, pressure controlled slide locks positively assure dependable locking uniformity after positioning.

DeVLIEG MACHINE COMPANY DEVLIEG JIGMIL **450 FAIR AVE. FERNDALE 20, (Detroit) MICH.**

Why don't you get together on proof that you both can count on?

Confidential note to machine-builders and manufacturers of mechanical products (with a couple of side remarks to users):—

It's as simple as this: Build into your machine or product, as an integral part, a Veeder-Root Counting Device that registers strokes, turns, pieces, trips, and many other units of performance . . . mechanically or electrically. Then your customers can *see* when your guarantee period is reached . . . for the Facts-in-Figures are right there in front of them in plain, bold black and white. So there's no room for argument, no needless loss of goodwill or future business through lack of positive proof.

There are Veeder-Root Devices that will record the exact number of performance-units constituting the guarantee period. And then these devices will go on proving to your customers that they're getting all the performance you built into your product. You are invited to take "*Count*sel" with Veeder-Root engineers, who will show you just how you can protect and profit yourself with built-in Veeder-Root *Count*rol.

The Counting House of Industry

VEEDER-ROOT INC.

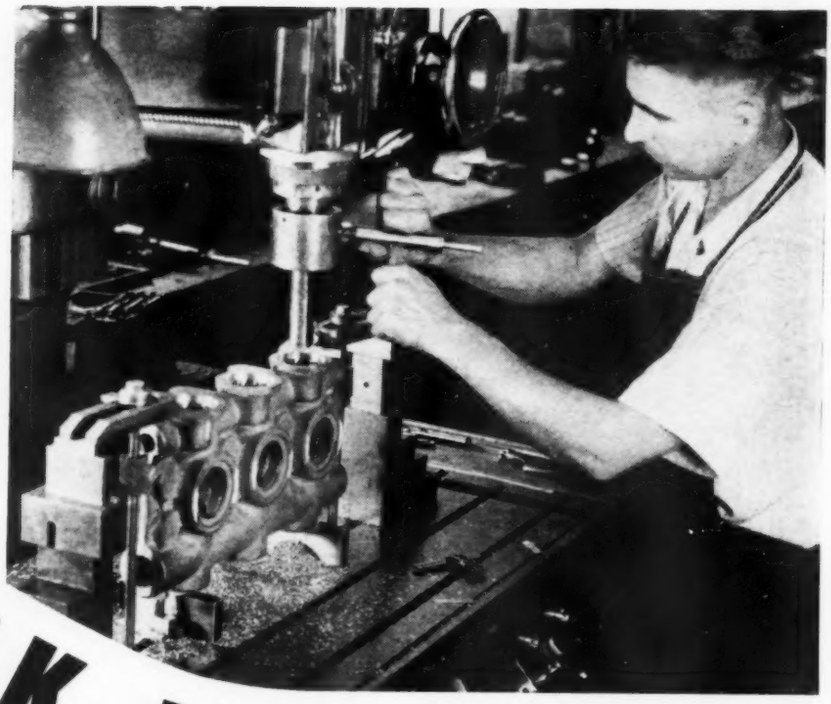
Hartford 2, Connecticut

In Canada: Veeder-Root of Canada, Ltd., Montreal
In England: Veeder-Root Ltd. (New address on request)

To

MEET CLOSE TOLERANCES AND MAINTAIN THEM

FOSDICK JIG BORER



● The Fosdick Jig Borer illustrated is maintaining tolerances of .0002 inch on boring operations on an alloy pump body casting.

Where the run is comparatively small, there are numerous jobs which can be handled on a Fosdick Jig Borer, to desired tolerances, without investing in expensive jigs or fixtures. Another important advantage — the initial cost of this machine is considerably less than heavy machine tools often required to obtain the same degree of accuracy.

Fosdick Jig Borers are being used extensively in tool rooms, tool and die shops throughout the country because of their ability to perform precision drilling, reaming, boring, facing and similar operations accurately — quickly — without the need for specially trained operators.

Here is a versatile, precision machine — economical both in first cost and operation.

Consult Fosdick on your precision boring, drilling, tapping, and similar operation. The Fosdick Jig Borer Bulletin J. B. A. gives you complete construction details and shows several typical installations. *Write for one.*

FOSDICK MACHINE TOOL COMPANY
CINCINNATI 23, · · · OHIO

It is reported that . . . . . .

One of the country's largest corporations announces that it will build a million-dollar plant for the making of prefabricated houses. Plans call for the starting of production about the middle of 1946, and capacity will be 1650 per year. *U. S. Steel Corp.*

get ready with CONE for tomorrow

A large chemical company promises to build a million-and-a-half dollar plant for the production of synthetic caffeine. The raw materials will be air and water. *Monsanto Chemical Co.*

get ready with CONE for tomorrow

During the war, the principle of mass production was applied to the making of marine chronometers, increasing the output from 400 a year to thousands. *Hamilton Watch Company.*

get ready with CONE for tomorrow

One of our leading technical colleges is planning to establish a gas turbine research laboratory which will include a supersonic wind tunnel and special facilities for the study of compressors, combustion devices, jets and other gas turbine elements. *M.I.T.*

get ready with CONE for tomorrow

Indication of industry's increasing use of the multiple spindle automatic is the recent announcement of the new five-spindle machine built by Warner & Swasey.

get ready with CONE for tomorrow

In a new radio-phonograph set the radio unit can be readily removed and used separately. *Westinghouse.*

get ready with CONE for tomorrow

A new mechanical cotton picker is designed to take advantage of the recently developed method of defoliating the plant by means of a chemical spray. *Charles R. Berry, Vicksburg, Miss.*

get ready with CONE for tomorrow

An optical company announces the development of a light-polarizing glass. Previous polarizers have been made of natural crystals or plastic film. *American Optical Co.*

Photo Courtesy Pantex Pressing Machine, Inc.

$$\textit{PRODUCTION TIME} = \frac{\textit{CYCLE TIME}}{4}$$

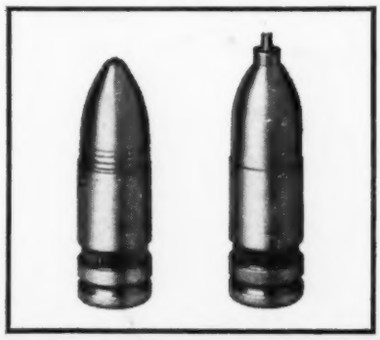
on the Vertical Conomatic

The Vertical Conomatic job shown here consists of a second operation where all four spindles are hopper-fed. A single operator produces 6,500 pieces per eight-hour shift — an average work cycle of 14 seconds—an average part production of 3½ seconds!

Although Vertical Conomatics can produce *4 like parts* during every cycle, they can be used to advantage for producing *dissimilar parts* during each cycle, within certain dimensional limitations.*

It will pay you to investigate the possibilities of the Vertical Conomatic on your own work. Write for details.

* Consult Cone for particulars.



JET PROPULSION TURBINES by BROACHING

Step 2

Broaching by *American* is a fast, accurate, economical method of production. Again and again during the war, industry turned to broaching, the *American* way, to solve metal finishing problems and speed output of the weapons of Victory.

One such problem was the shaping of slots in jet propulsion turbines. For cutting rough slots of proper depth and spacing, an *American* SB-66-15 Vertical Surface Broaching Machine was equipped with a three stage broach assembly.

Each member of the assembly made progressively deeper cuts. The part, with two slots partially cut, was placed in the machine so that the shallow slot came to the center broach and the slightly deeper one came to the right-hand broach. Then the part was automatically indexed with all three broaches cutting shallow, deeper, and full depth slots respectively.

Broaching the *American* way, can help speed output and reduce costs in your plant. Let *American's* complete broaching service — machines, tools, and engineering — work for you. Write today for more information. There is no charge.

WATCH THIS PAPER for another operation in broaching jet propulsion turbines. Step 3—Finishing—will be described in *American's* March 28th advertisement. The first step was described in the December 6th issue.

MEMBER BROACHING TOOL INSTITUTE

American BROACH AND MACHINE CO.

ANN ARBOR, MICHIGAN

•

BROACHING MACHINES
PRESSES
BROACHING TOOLS
SPECIAL MACHINERY

DIVISION OF SUNDSTRAND MACHINE TOOL CO.

MODERN DESIGNS
SELECTED STEELS
SCIENTIFIC HEAT TREATMENT

BROWN & SHARPE CUTTERS – give outstanding performance – keep production high – costs low.

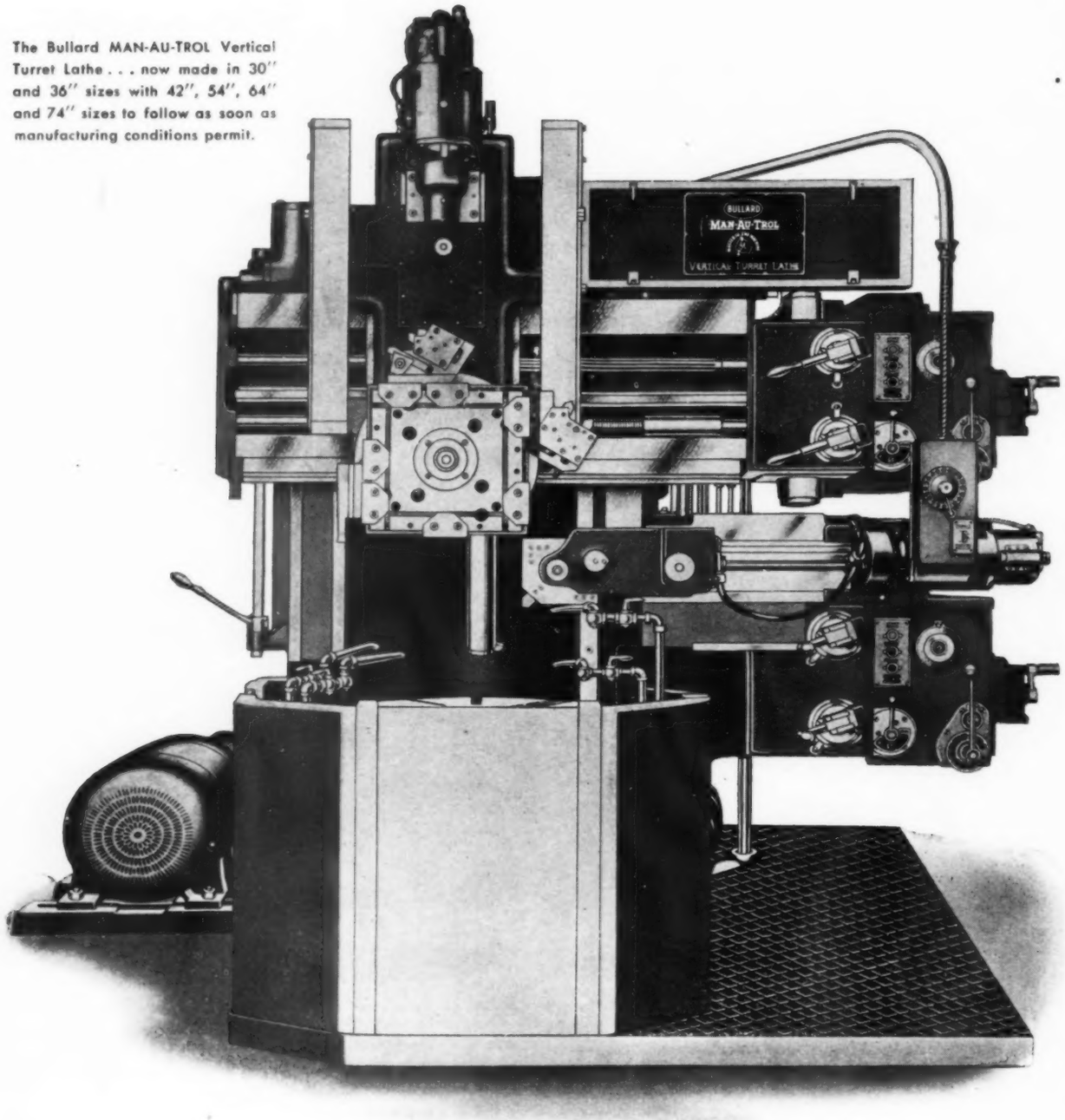
Catalog No. 34 sent on request.

BROWN & SHARPE MFG. CO. • • Providence 1, R. I., U. S. A.

. . . . We urge buying through the Distributor

BROWN & SHARPE CUTTERS

The Bullard MAN-AU-TROL Vertical Turret Lathe . . . now made in 30" and 36" sizes with 42", 54", 64" and 74" sizes to follow as soon as manufacturing conditions permit.



How short a run can an automatic machine handle efficiently?

NOW . . . one piece or thousands!

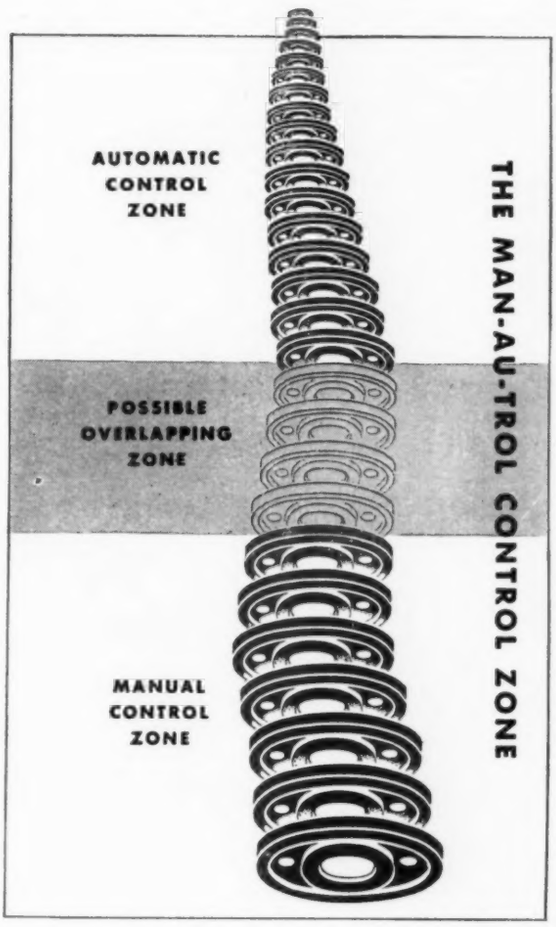
BULLARD
MAN-AU-TROL
MASTER OF THE MACHINE

BULLARD CREATES *NEW METHODS*

The reason is...

BULLARD MAN-AU-TROL

The automatic control that is as versatile as manual control



Now an automatic machine can be kept busy on short or long runs if it's a Bullard MAN-AU-TROL machine.

The Bullard MAN-AU-TROL principle of automaticity makes *one* machine *both* an automatic machine and a manually-controlled machine. On short runs, you can operate it manually. On longer runs . . . about 10 or more pieces . . . you can set it up quickly and easily for 100% automatic operation.

Such unique versatility provides greater efficiency for diversified shop schedules . . . lower unit costs to meet modern economic needs.

At present, MAN-AU-TROL is being built into Bullard machines only.

The proof is...

BULLARD MAN-AU-TROL *Vertical Turret Lathe*

See how the Bullard MAN-AU-TROL Vertical Turret Lathe solves production problems that are on your mind these days:

1. Lightens Labor's Load because the operator machines the first piece under manual control while easily setting the operations for automatic cycle . . . then merely loads, supervises and unloads when MAN-AU-TROL's 100% automaticity takes over.

2. Makes One Machine Do More because it automatically machines any class of work within manual-control range . . . is instantly convertible to manual operation on the same or a different piece without affecting the automatic cycle.

3. Cuts Automatic Set-Up Time because set-up time from one class of work to another is only slightly more than for a manually-operated machine.

4. Reduces Spoilage because it operates continuously to a degree of accuracy no manual operator can duplicate.

Engineering data and other facts on the Bullard MAN-AU-TROL Vertical Turret Lathe are yours for the asking. Write for Bulletin MAV-G-1 today. The Bullard Company, Bridgeport 2, Connecticut.

TO MAKE MACHINES DO MORE

HIGH PRODUCTION BY A WARNER & SWASEY

At Marvin Machine Products Company, Milwaukee, production was already high on the job. Using a Warner & Swasey No. 5 Universal Turret Lathe, the Marvin Company turned out 678 bushings per 50-hour week from 2½" hot rolled bar stock. Each piece called for five operations—drilling, rough boring, finish boring, turning and cutting off.

Yet when a Warner & Swasey Collet Chuck Booster was installed, production jumped from 678 to 873 pieces per week—an increase of 28½%! By taking the hard work out of tightening the collet chuck, the Warner & Swasey Electric Booster permits the operator to conserve all her strength and attention for the machining job.

Today, a girl operator weighing 118 pounds is setting new production records, with far less scrap loss and without chucking trouble or evident fatigue.

If you have or expect a job calling for frequent collet chuckings, ask a Warner & Swasey Field Engineer to give you an idea of how much a Warner & Swasey Collet Chuck Booster will up production! Or write Warner & Swasey, Cleveland.

TURRET LATHES, SADDLE AND RAM TYPES . . . MULTIPLE SPINDLE AUTOMATICS
CHUCKING AND BAR TOOLS . . . PRECISION TAPPING AND THREADING MACHINES

YOU CAN MACHINE IT BETTER, FASTER, FOR LESS . . .

UPPED 28½%

COLLET CHUCK BOOSTER

On a tough, high production job, this girl operator now produces 28½% more using a Warner & Swasey Collet Chuck Booster.

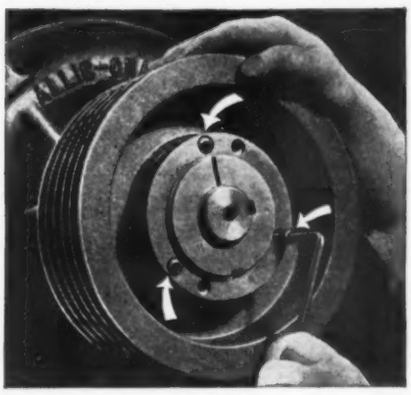
...WITH A WARNER & SWASEY

WARNER & SWASEY
Machine Tools
Cleveland

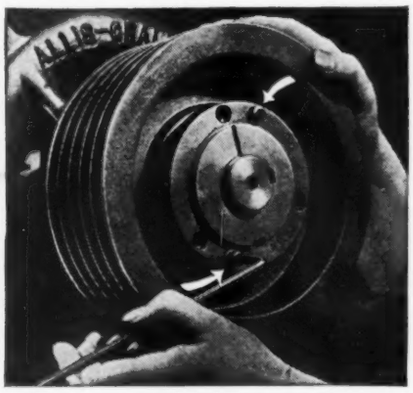
Changing was a job for but now could do it

No bulging muscles needed! Allis-Chalmers' new "Magic Grip" — *fastest mounting and demounting sheave on the market* — slides on and off *easily!*

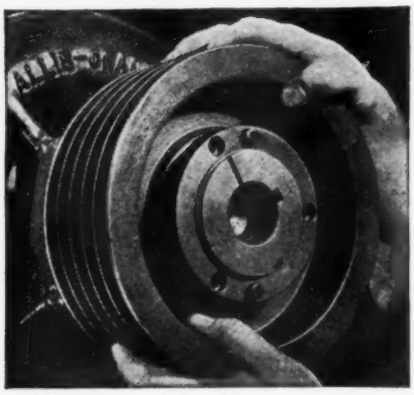
SEE HOW QUICKLY AND EASILY THIS SHEAVE COMES OFF THE SHAFT



1 **Remove three capscrews** from bushing collar. A handy wrench — supplied with each sheave — is the only tool needed to remove Allis-Chalmers' new "Magic-Grip" from motor or machine shaft quickly and easily.



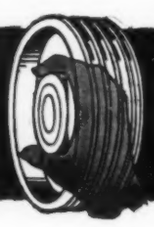
2 **Insert two capscrews** in tapped holes. As screws are turned, they become levers . . . automatically breaking tight grip of tapered split bushing on sheave and shaft. Entire unit is then ready for removal.



3 **Remove sheave from shaft.** Requires no mallet, no prying, no bulging muscles. You just slide the sheave off . . . smoothly, quickly. *It costs nothing extra!* Send for B6310. Allis-Chalmers, Milwaukee 1, Wis.

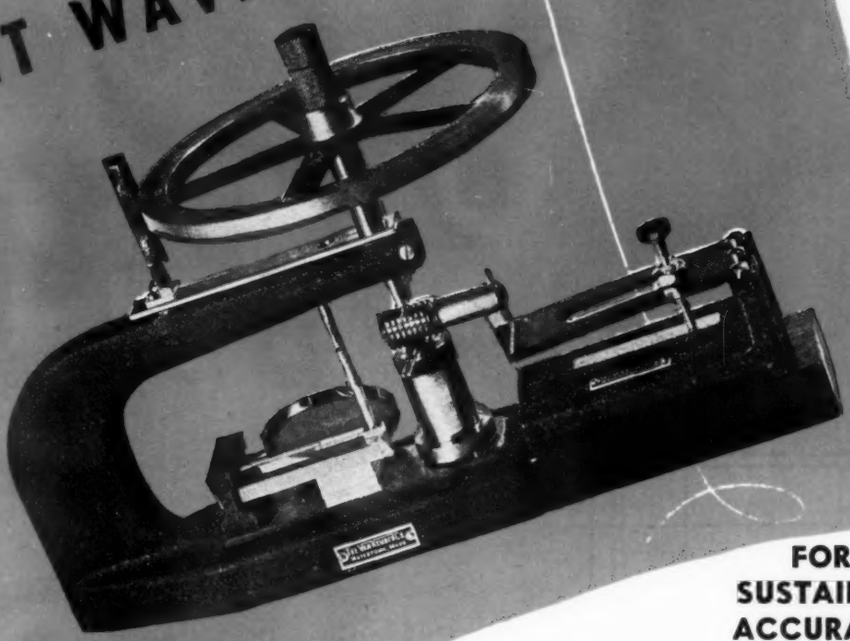
A 1856

Allis-Chalmers Texrope

"MAGIC-GRIP"  **SHEAVES**

Van Keuren

LIGHT WAVE MICROMETER



FOR SUSTAINED ACCURACY

The Van Keuren light wave micrometer is described in catalog No. 33. This book also gives complete tables and simplified formulas for measuring all standard threads, splines and spur gears. *Write for your copy!*

NEW SYSTEM OF ACCURACY—The Van Keuren light wave micrometer is an instrument which has formed the basis for an entirely new method of maintaining high standards of accuracy. No gage blocks are required. Errors from worn gage blocks will not be constantly duplicated in the product.

A calibration chart showing the micrometer screw corrections to .00001" is furnished with each instrument. The new type of hardened and ground precision micrometer screw actually improves with use. Fine workmanship and carboloy wearing surfaces make the instrument accurate and dependable for years of constant service.

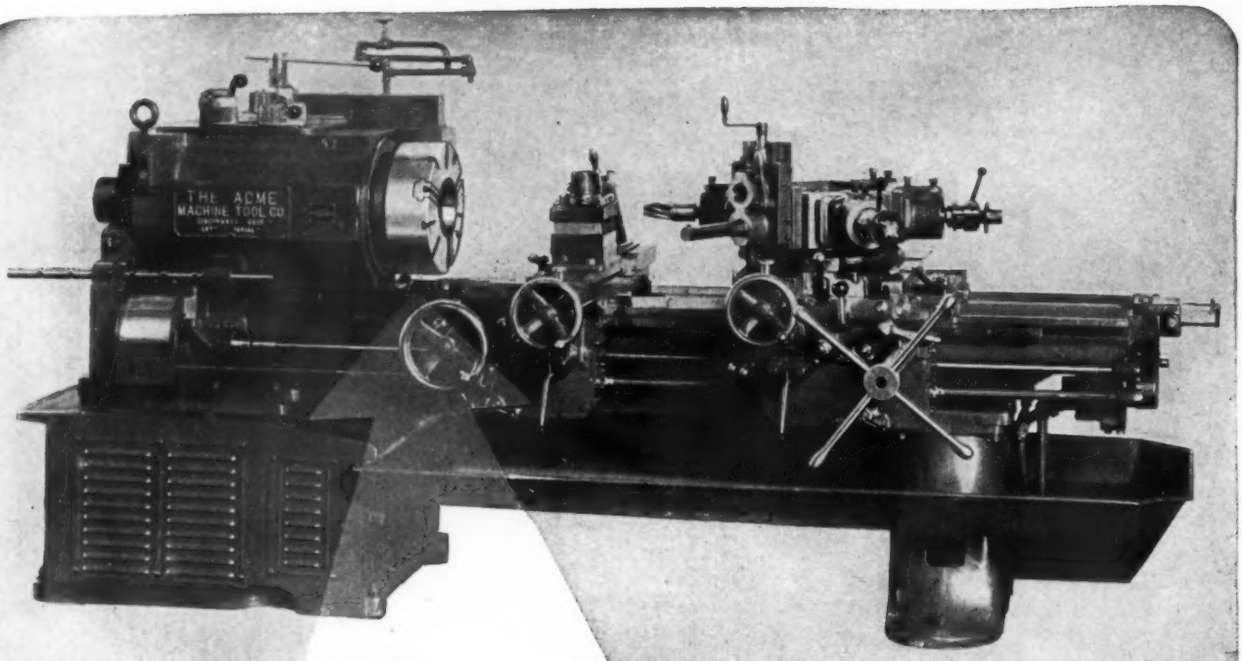
CONTROLLED PRESSURE ASSURES UNIFORMITY—By using the sensitivity of light waves the light wave micrometer insures the exact duplication of measuring pressure by any operator. This controlled pressure feature makes it possible to measure hard or soft materials, and for readings to be duplicated by different operators to .00001".

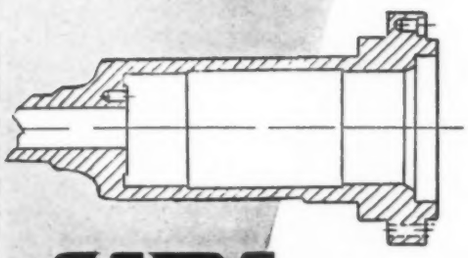
IDEAL FOR SHOP MEASUREMENTS—The light wave micrometer is ideal for making measurements by the 3 wire method, for measuring plug gages, measuring wires, precision parts and shop standards. It is a reference instrument. Forget about comparative measurements with gage blocks—use the light wave micrometer. It is fast, accurate and profitable.

THE Van Keuren CO., 176 WALTHAM ST., WATERTOWN, MASS.

27th ANNIVERSARY

Light Wave Equipment • Light Wave Micrometers • Gage Blocks • Taper Insert Plug Gages • Wire Type Plug Gages • Measuring Wires • Thread Measuring Wires • Gear Measuring System • Shop Triangles.





ACME gives greater spindle capacity

Now you can profit from increased versatility in this deep throat Acme Universal Turret Lathe. Designed especially to machine those forgings, tubings and similar large diameter pieces requiring a deeper throat and greater chuck capacity, this Acme Turret Lathe is a welcome addition to your plant.

This machine, likewise, includes a triple roller bearing spindle and brake, hardened steel vees, extended square turret cross slide and rear tool post, and rapid power traverse for longitudinal movement of the hexagon turret. All moving parts run in an oil bath.

We'll be pleased to furnish you specific information at your request.

The ACME MACHINE TOOL Co.
CINCINNATI 32, OHIO

How To Buy
PRATT & WHITNEY MACHINES
from U. S. Government Surplus Stock

We are glad to offer our help and experience to prospective buyers of Pratt & Whitney machines that are offered for sale as surplus equipment. If you are interested in acquiring a government surplus Pratt & Whitney machine tool, go to the nearest P&W Branch Office and make your wants known. We will work with you and the RFC Office to find the machine that suits your requirements. We will give you the specifications and literature covering our *standard model* of that particular type.

To all prospective buyers of P&W machines we wish to offer a word of advice. Included in government surplus stock are many *special* P&W machines . . . standard models that have been either specially tooled, or adapted to a particular job, or modified for special purposes. Such machines are *not usable for general work* until they have been reconverted to standard.

We are anxious to see that every future owner of a Pratt & Whitney machine tool bought from government surplus is getting fully satisfactory results from his purchase. For complete details contact our nearest Branch Office as listed below and talk to our engineers.

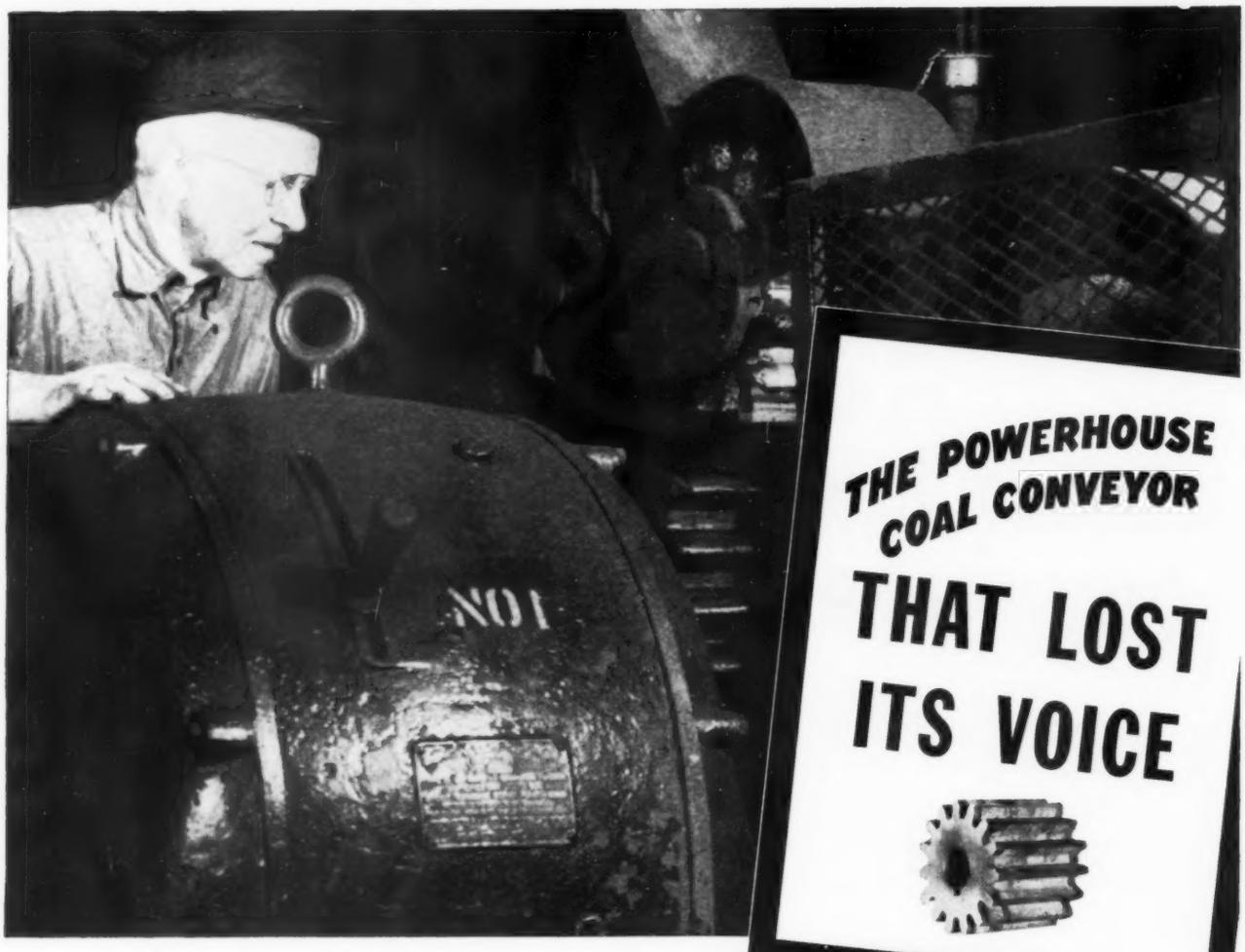
Branch Offices and Agencies: Birmingham Boston Chicago Cincinnati Cleveland Detroit Los Angeles New York Philadelphia Pittsburgh Rochester San Francisco St. Louis

PRATT & WHITNEY

DIVISION NILES-BEMENT-POND COMPANY

WEST HARTFORD 1 • CONNECTICUT

Accuracy



THE POWERHOUSE COAL CONVEYOR THAT LOST ITS VOICE

G-E NONMETALLIC GEARS CUT NOISE— REDUCED GEAR REPLACEMENTS

In a large industrial powerhouse, G-E Fabroil nonmetallic gears are used on the coal conveyors. They do a good job in silencing this heavy equipment and also save money on gear replacements.

The bucket conveyor gears made a terrific noise before G-E Fabroil gears were installed . . . men working in the powerhouse said, "The racket could be heard for blocks, but now we can talk near the machines and be heard."

An endless belt type of conveyor which is over 500 feet long and carries the pulverized coal to the boilers also utilizes G-E Fabroil gears. This conveyor travels fast and has vibration. Metal gears lasted but months—Fabroil gears are lasting for years.

A wide variety of applications can be covered with G-E nonmetallic gears because two types are manufactured . . . Fabroil for heavy-duty applications—Textolite for lighter ones. They are both strong and tough, a factor which contributes to long life—fewer delays and shutdowns of your machines—and money saved on gear maintenance.

EVERYTHING IN *Plastics*

For further information or our bulletin, "Silent Gears," write to Section Y-1, Plastics Divisions, General Electric Company, One Plastics Avenue, Pittsfield, Mass.

GENERAL ELECTRIC

CD-46-F1

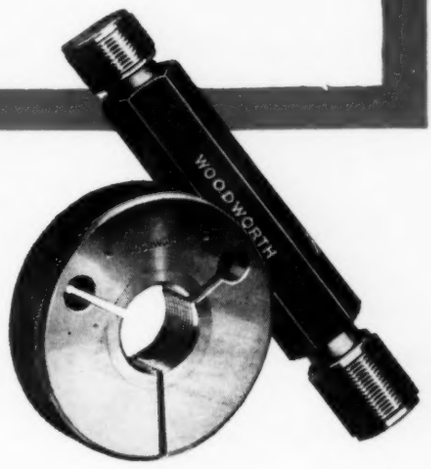
Proved!

Every Woodworth product must conform to the basic policy of the N. A. Woodworth Company — to produce only the most accurate tools and gages with longest possible service life at lowest initial and operating costs.

That is why Woodworth precision tools and gages must first be pre-tested—PROVED — in our own laboratories.

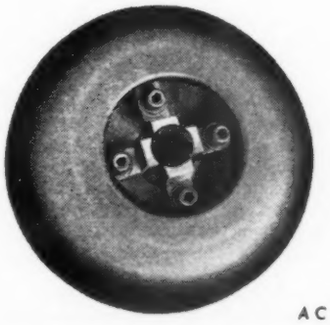
That, too, is why they're continually PROVING themselves in actual production—adapting themselves to an ever greater variety of difficult industrial applications.

1. Speed up production and reduce costs with Limitrol. The Limitrol Comparator Type Snap Gage checks errors involving pitch diameter, lead, taper, angle, out-of-roundness. It eliminates "feel" and reduces scrap. Write for Folder 44-L.



2. Woodworth has made an enviable reputation in industry with its long-life thread, plug and ring gages made of such wear-tested materials as steel, Durplate, Norbide, Carboloy, Stellite and Nawlide. Write for Catalog 44-G.

3. The Woodworth "Cone-Lok" Jig for instantaneous positive clamping action is rugged, adaptable, mechanically simple. Fully sealed-in lubrication. Low maintenance cost. Wide range of sizes in three styles. Write for Catalog 45-J.



4. The new Woodworth Diaphragm Chuck — speedy and accurate — for precision grinding, boring and turning operations. Steps up production 2½ times. Eliminates "scrap." Write for Catalog 45-C.

Bridge Type Jig for heavy duty.

All Purpose Jig for general machine shop work.

"Up-Clamp" Type Jig for close tolerance work.

The Cone-Lok fixture clamp and Cone-Lok unit use the same principle and are available for special jigs and fixtures. Ask for data sheet.

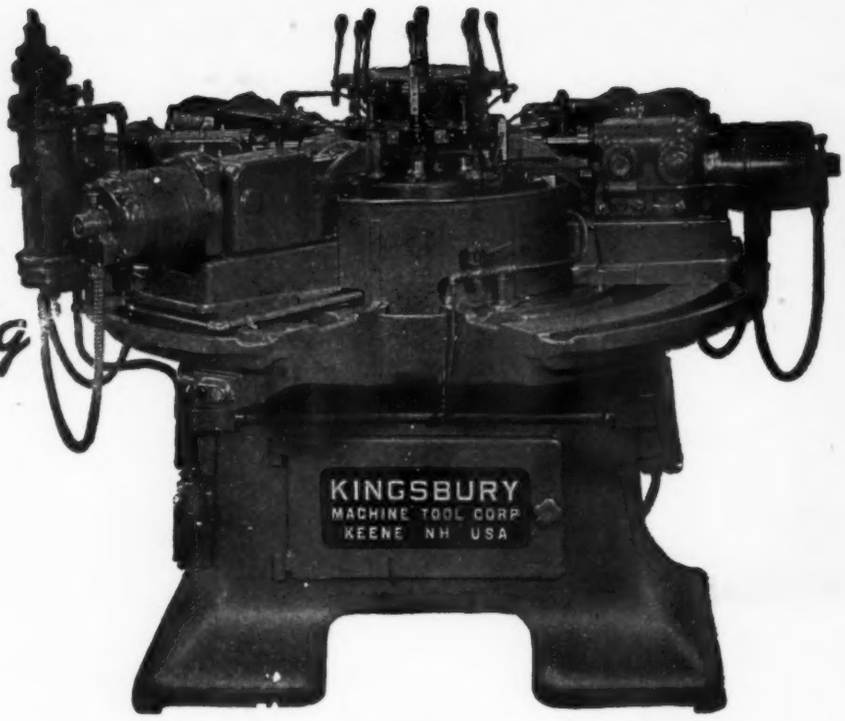
ACCURACY YOU W CAN TRUST

WOODWORTH

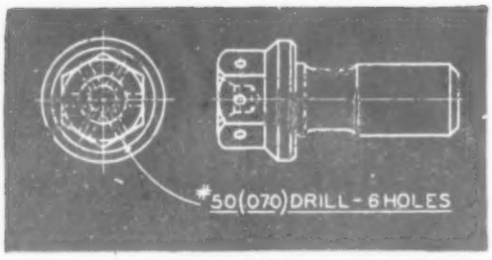
N. A. WOODWORTH CO., SALES DIVISION, 1300 E. NINE MILE ROAD · DETROIT 20, MICHIGAN

PRECISION GAGES · PRECISION MACHINED PARTS · PRECISION TOOLS

Loading and Unloading While Drilling assures Continuous High Production



FLEXIMATIC



by KINGSBURY

THIS IS A FLEXIMATIC AIRPLANE JOB!

Kingsbury Standard Units for drilling, reaming, boring, spotfacing and milling can be mounted in any combination, operated automatically and changed over quickly and easily to suit the requirements of the work to be handled.

This six-spindle **FLEXIMATIC** is set up for drilling lacing holes in the heads of screws for airplane motors. High production, at low cost so essential to post-war production, can be achieved with minimum effort on the part of the operator.

The main turret of this **FLEXIMATIC** contains eight individual turrets which index 60° at each index of the main turret. Each of the six automatic drilling units on the machine drill a hole from the outside face of the hex head into the center only. The operator merely loads and unloads at the loading station while the holes are being drilled at the other stations on the machine. All six drilling operations are performed in a single chucking of the work.

Speed, convenient handling, accuracy and continuous production are universally recognized advantages offered by **FLEXIMATICS** regardless of the nature of the job assigned them to handle. The specific work being performed here is typical of many others where **FLEXIMATICS** are the machines for jobs calling for the maximum in time savings.

KINGSBURY MACHINE TOOL CORPORATION
KEENE NEW HAMPSHIRE U S A

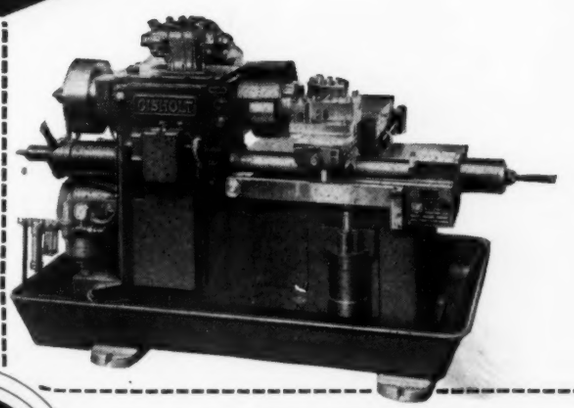
FORTY DIFFERENT JOBS ON ONE AUTOMATIC LATHE

Here they are! Forty different sizes and types of parts—all produced in lots as needed on this *one* automatic lathe.

This is the kind of production ability you can expect from the Gisholt Hydraulic Automatic Lathe. It permits easier changeover from job to job than you've ever before known on *any* automatic. It frees you from most of the usual limitations. And accuracy is easier to maintain—more dependable.

As for speeds and feeds, here's all you can use—up to the limit the cutting tools will withstand. What's more, with its completely automatic cycle, this machine doesn't take the operator's full time. He can (and usually does) operate two or more machines. It's that easy.

If high-speed, low-cost production fits into your picture, get all the facts about the new Gisholt Hydraulic Automatic Lathe.



THE GISHOLT HYDRAULIC AUTOMATIC LATHE is a rugged 12" machine with unusual versatility. Independent feeds for front and rear slides provide an infinite selection of feeds from .000" to .058" for either carriage. There is no changing of cams or gears for different jobs. Write for literature.

GISHOLT MACHINE COMPANY

1201 East Washington Avenue • Madison 3, Wisconsin

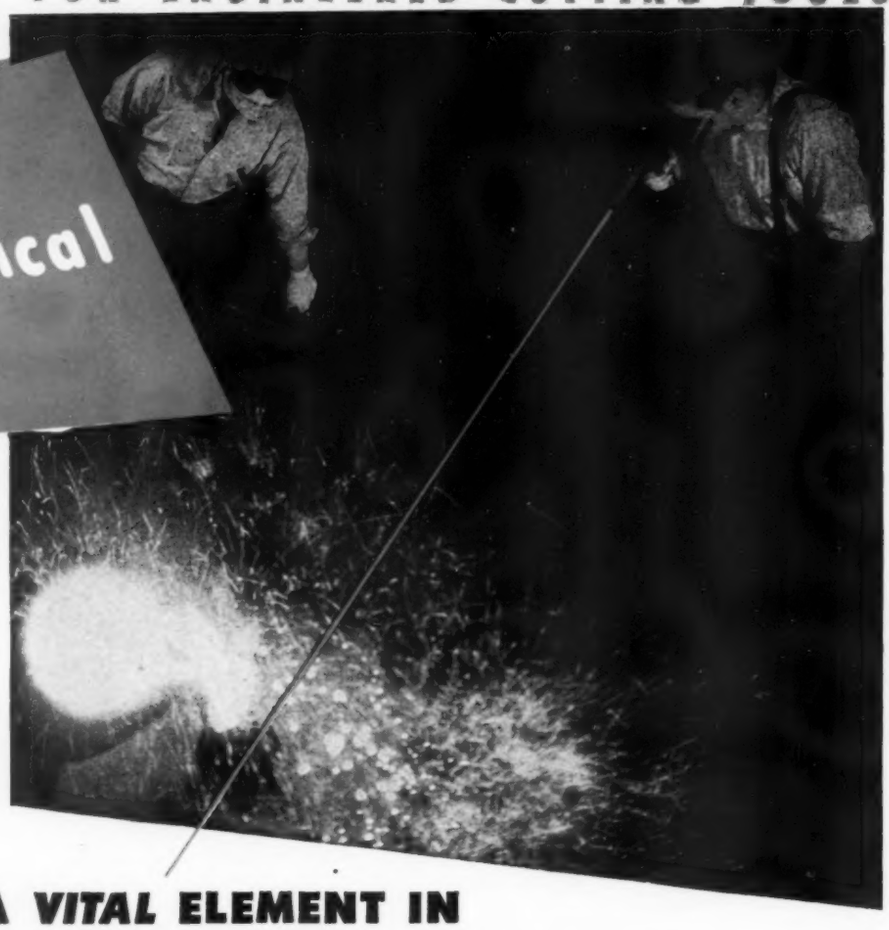
Look Ahead . . . Keep Ahead . . . with Gisholt Improvements in Metal Turning

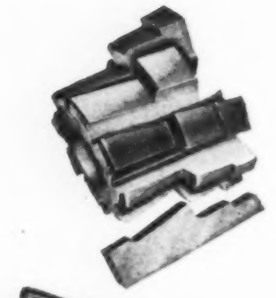
GISHOLT

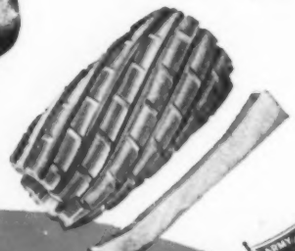
TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES

HEADQUARTERS FOR ENGINEERED CUTTING TOOLS

Constant Metallurgical Research







A VITAL ELEMENT IN
ILLINITE CUTTING TOOLS

Progress in metal cutting tool efficiency demands constant research with new alloys. Illinois Tool metallurgists through continuous experimentation have developed many new qualities in high speed steel which are producing exceptional results on a wide variety of metal cutting applications. Enjoy the benefits of this research by asking for an Illinois Tool engineer. Your tooling will be analyzed in consultation with our metallurgists to assure properly engineered tools produced from the alloy proved most efficient for your purpose.

Overnight to All America . . .
From the Hub of Air Transportation

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TOOL WORKS

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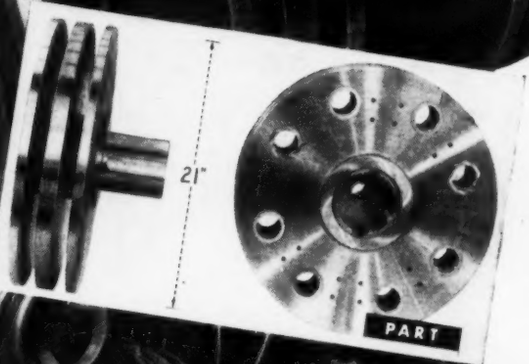
MANUFACTURERS OF METAL CUTTING TOOLS AND SHAKEPROOF PRODUCTS

HOW TO MACHINE DEEP GROOVES on a STANDARD *GISHOLT* TURRET LATHE

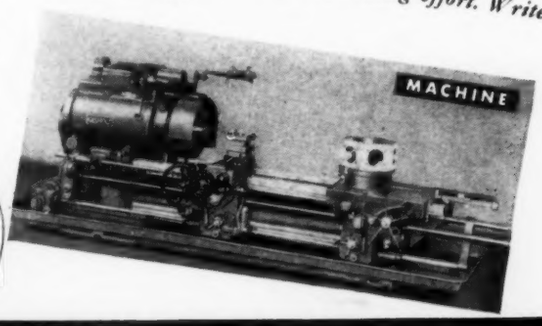


Here's an interesting example of extremely heavy machining done on a standard Gisholt 4L Saddle Type Turret Lathe. It indicates how many a job may be handled with equipment already on the floor and without changes in the base design of the machine.

Heat-treated steel forgings for 21″ diameter vibration dampeners for Diesel engines were machined from the solid, with simultaneous cutting of two grooves 7¼″ deep by 1-3/16″ wide. The only special attachment required on the Gisholt was an auxiliary tool holder and base to hold the long grooving tools. Roughing and finishing cuts were taken, holding to close tolerances for size and squareness, in a total cutting time of one hour and 29 minutes.

For those interested in complete details, some reprints of an article on this unusual job have been made available. Write for your copy.

THE GISHOLT 4L provides extreme rigidity for heavy cuts with bed and headstock cast integrally and thick block-type ways of hardened steel which support all bearing surfaces for heavy carriages. This large and powerful machine requires surprisingly light operating effort. Write for literature.



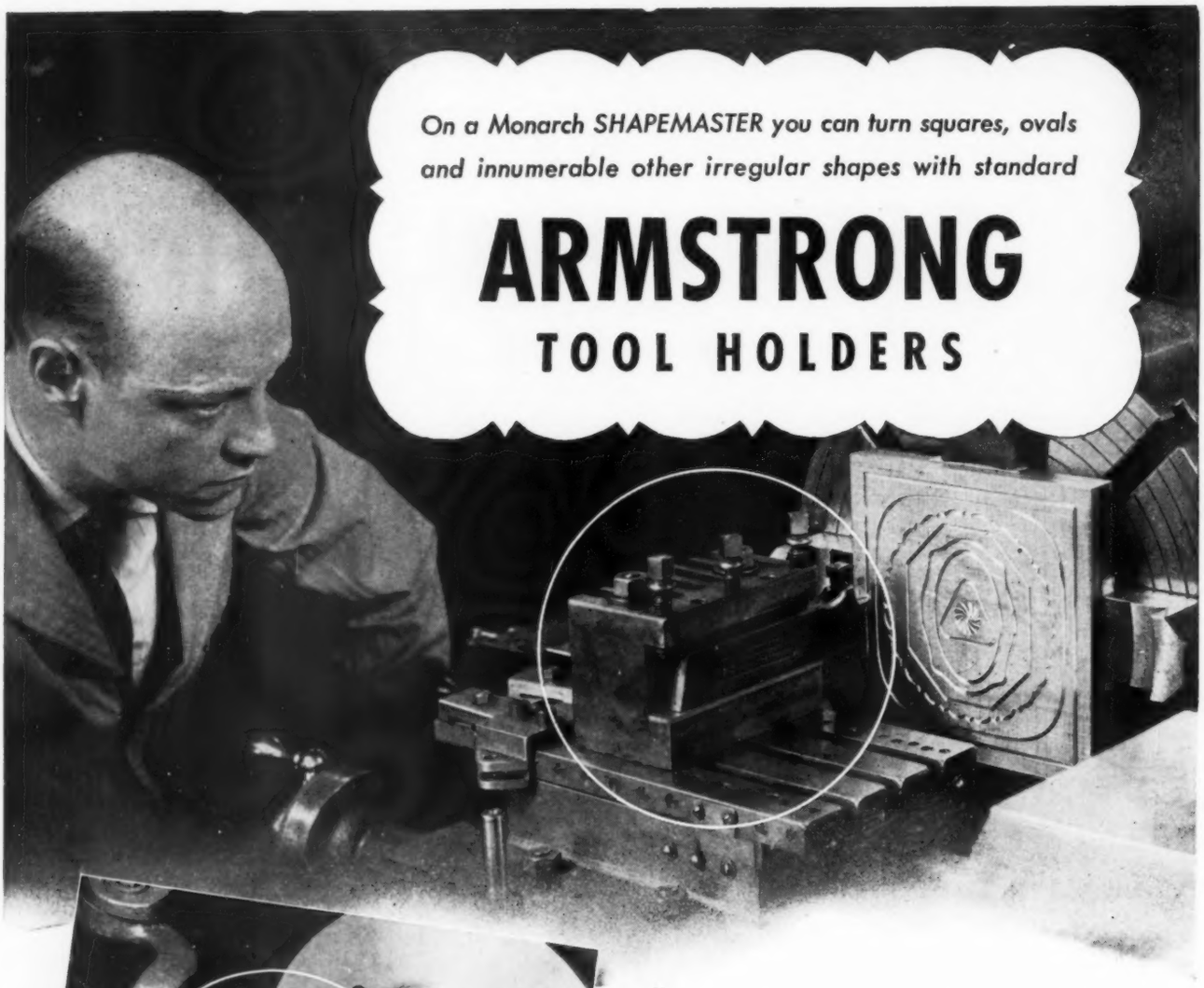
GISHOLT MACHINE COMPANY
1201 *East Washington Ave.* • *Madison 3, Wis.*

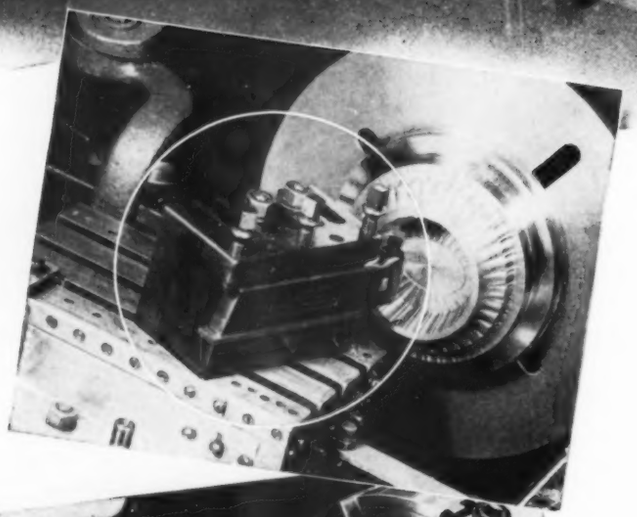
Look Ahead . . . Keep Ahead . . . With Gisholt Improvements in Metal Turning

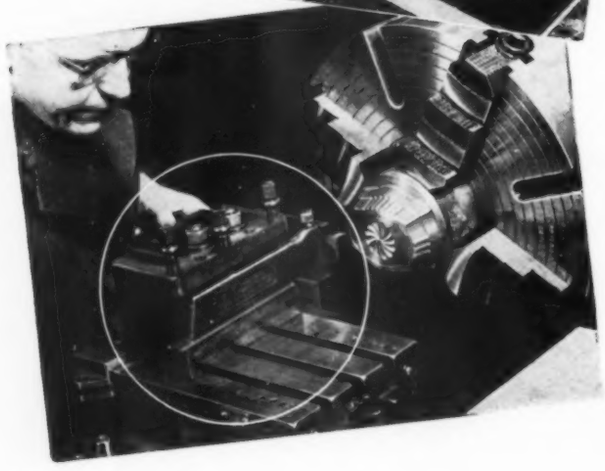
TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES

On a Monarch SHAPEMASTER you can turn squares, ovals and innumerable other irregular shapes with standard

ARMSTRONG
TOOL HOLDERS





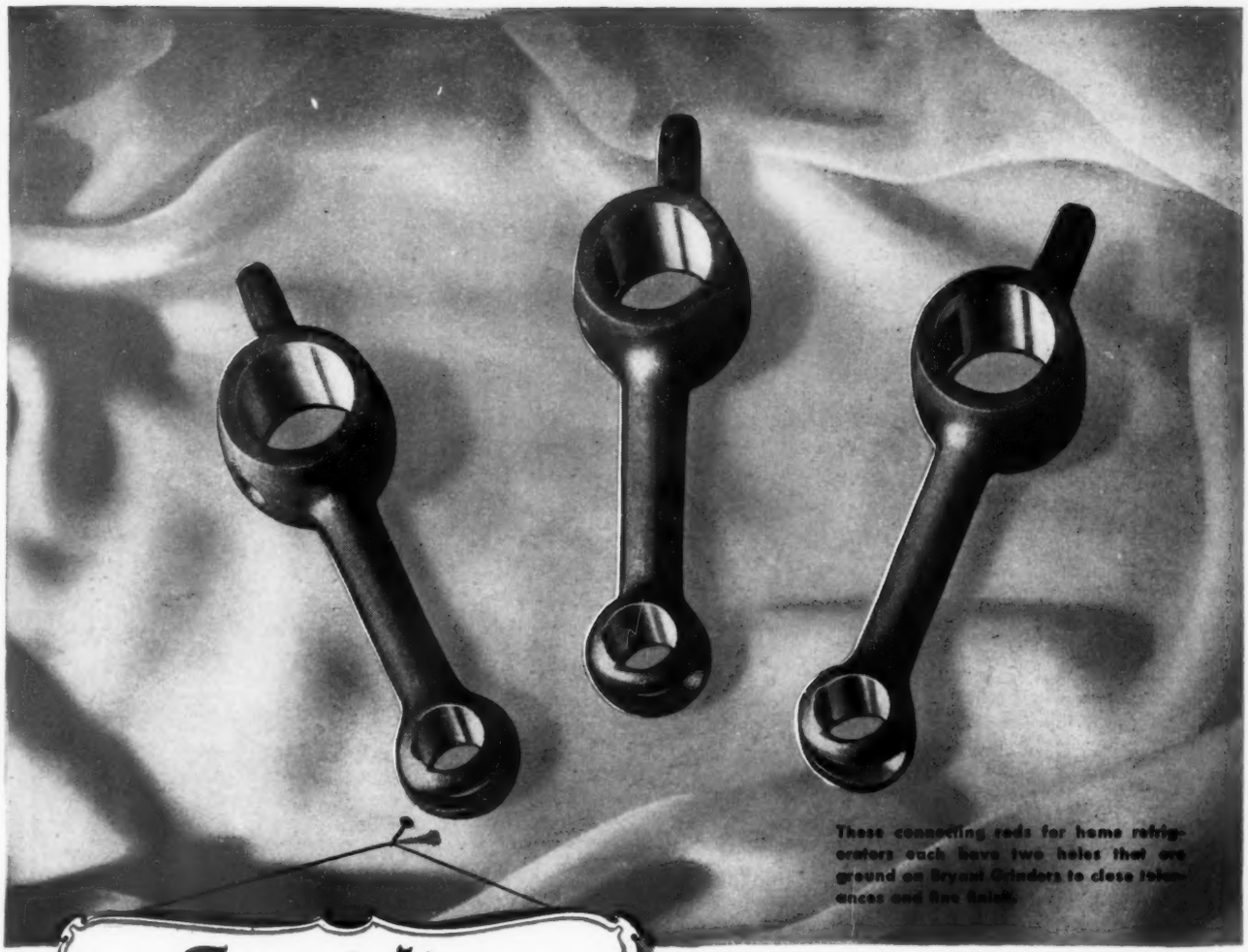


The phenomenal Monarch SHAPEMASTER performs the most astonishing operations. Basically a 20" Monarch Lathe, when fitted with the SHAPEMASTER Mechanism, it will turn squares, ovals, hexagons, octagons and multiple sided shapes in irregular contour pieces. Almost any desired shape can be transmitted by the cutting point to either outside or inside diameter or face of the work.

The result of many years of engineering and development, the SHAPEMASTER is distinctly *modern* and advanced in its design in every detail. Still, for most of its unusual operations it is tooled with ARMSTRONG TOOL HOLDERS, of the standard types universally used on ordinary lathes in 96% of the machine shops and tool rooms.

These ARMSTRONG TOOL HOLDERS are selected not only because they "Save: All Forging, 70% Grinding and 90% High Speed Steel" but also because they have the strength to support the cutting edge rigidly not only against a normal down feed but against end thrust, side and torsional strain as well.

ARMSTRONG BROS. TOOL CO.
"The Tool Holder People"
315 N. Francisco Ave. Chicago 12, U.S.A.
Eastern Sales Office & Whse.:
199 Lafayette St., New York 12, N. Y.
Pacific Coast Whse. and Sales Office:
1275 Mission St., San Francisco 3, Calif.



These connecting rods for home refrigerators each have two holes that are ground on Bryant Grinders to close tolerances and fine finish.

Specialists in Forged Steel Jewelry

No, we don't sell it; we don't make it, but we do build internal grinding machines that make it. The three connecting rods for home refrigerators, shown above, are typical examples of the type of work that is ground on Bryant Internal Grinders. They are truly jewel-like in their finish, but that is not enough—to be sure, Bryant Grinders produce metal parts that have surfaces finished correctly to millionths of an inch, when desired, but Bryant machines also produce these same parts with holes that are truly round and straight. These are basic elements that Bryant insists upon to assure Bryant users that their parts and products will last for years without mechanical failure.

WE KNOW YOUR PROBLEM IS DIFFERENT . . .

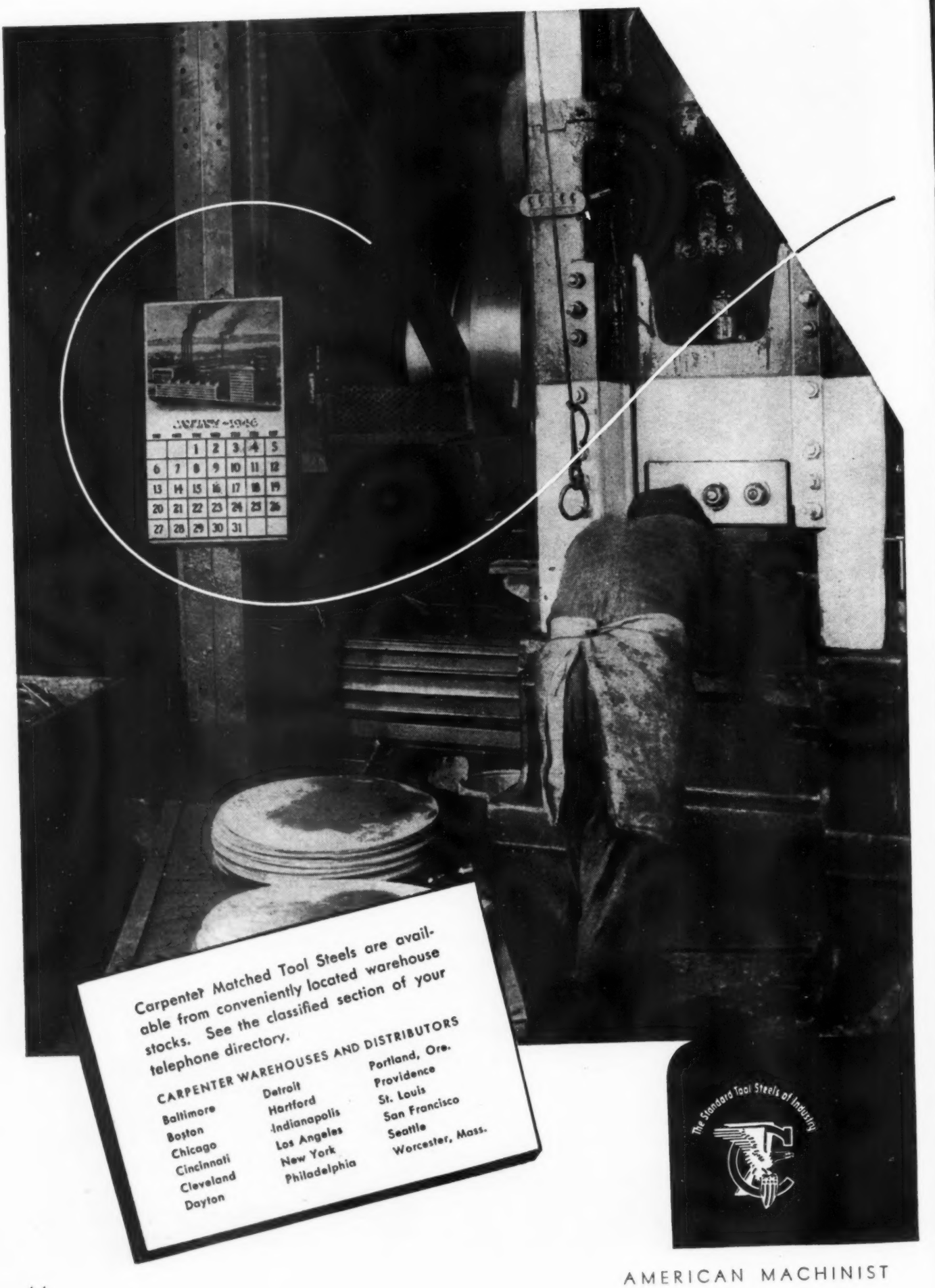
. . . practically every internal grinding problem is different. But when you require extreme accuracy or high production, *or both,* your first step should be to study your problem with a man who makes it his business to solve them. Your first step should be to—

Send for the Man from Bryant!

BRYANT

BRYANT CHUCKING GRINDER CO.

SPRINGFIELD, VERMONT, U. S. A.


JANUARY-1946
1 2 3 4 5
6 7 8 9 10 11 12
13 14 15 16 17 18 19
20 21 22 23 24 25 26
27 28 29 30 31
Carpenter Matched Tool Steels are available from conveniently located warehouse stocks. See the classified section of your telephone directory.
CARPENTER WAREHOUSES AND DISTRIBUTORS
Baltimore
Boston
Chicago
Cincinnati
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Indianapolis
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St. Louis
San Francisco
Seattle
Worcester, Mass.
The Standard Tool Steels of Industry

How Much EXTRA Production Can Your TOOLS & DIES Give You Each Month?

Extra output from your tools will cut unit costs. With this 3-step *job analysis* program you can actually predetermine tool performance on each job. For more output per month and lower production costs, put this 3-step plan to work now.

1. Your Real Key to More Output From Tools

By knowing *in advance* what performance to expect from your tools you can reduce idle machine and press time. And the Carpenter Matched Set Method gives you a way to do just that. It's a sure-fire way to get tools that need fewer regrindings and replacements. This 167-page Manual points the way to the tool steel properties you need—greater wear resistance, more toughness, etc. With its 80-page Tool Index and Steel Selector you can quickly find the best starting place when you have a new tool to make. For easier tool steel selection and better results on the job, send for this Carpenter Manual. Just drop us a note on your company letterhead.

2. Lick Hardening Trouble At the Start

Proper heat treatment is the second step to better tools that increase production. To get the heat treating results you want, use the "Matched Tool Steel Manual". It contains the most complete heat treating information available in printed form. And as a special help to your heat treaters, we have prepared a handy slide chart that condenses the basic heat treating information and puts it in easy-to-use form. Drop us a line and let us know how many Carpenter heat treating slide charts you will need.

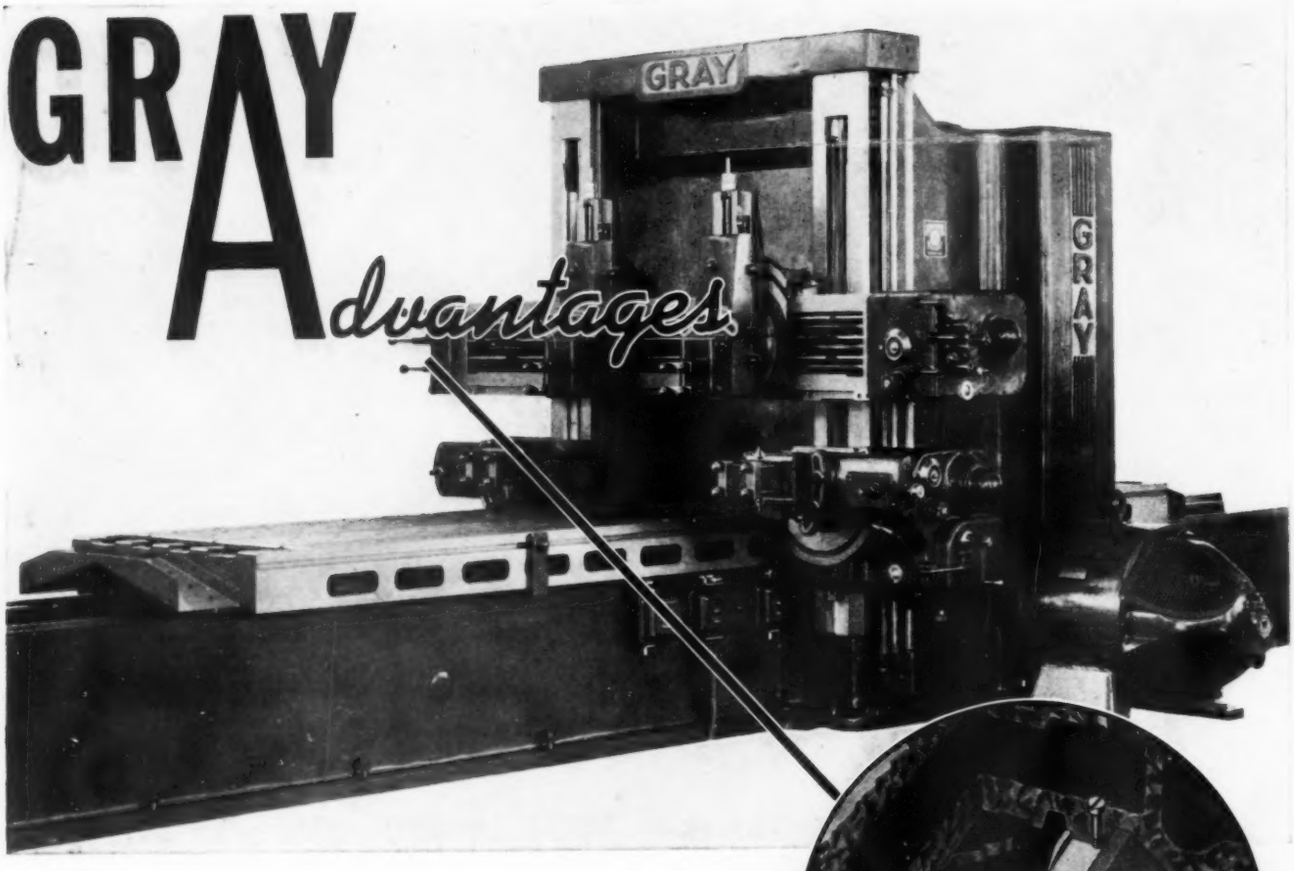
3. Keep Records of Tool Output Per Grind

Follow each tool set-up on the job. Check the reasons for any premature failure or too frequent regrinding. You'll soon spot new ways to make your tools save production time—and money. And when you want personal help with a tooling problem call on your nearby Carpenter representative. He really knows tool steel and can help you reduce costs all along the line.

THE CARPENTER STEEL COMPANY
109 W. Bern St., Reading, Pa.

Carpenter MATCHED TOOL STEELS

GRAY Advantages



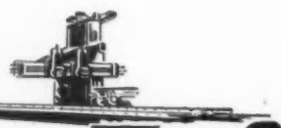
The GRAY TABLE SAFETY STOP

The Gray patented safety stop will stop the table in the event it runs off the bull gear due to failure of the reversing mechanism. This Gray safety stop consists of cutting tools bolted to each end of the bed arranged so as to engage stop blocks bolted to the underside of the table, as illustrated. The table is brought to rest by the tools cutting into the stop block. The tools do not engage the block until the table rack is run off the bull gear. This simple patented device gives unfailing protection to both equipment and personnel even though it may not be necessary for the safety stop to function during the life-time of the machine.

Sold in Canada by Upton, Bradeen and James Ltd.
Sold in Latin America by Machine Affiliates.

DOUBLE HOUSING and OPENSIDE PLANERS
•
SWITCH PLANERS
•
DIE BLOCK PLANERS
•
MILLING PLANERS

PLANER TYPE MILLING MACHINES
•
HORIZONTAL BORING MACHINES



The G.A. GRAY Co.

CINCINNATI 7, OHIO, U. S. A.

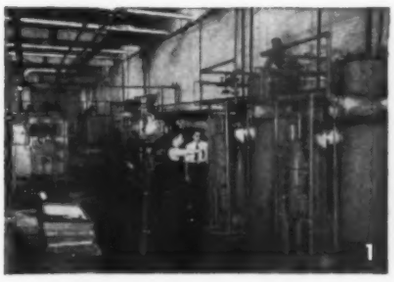
Performance—Economy . .
One source of supply

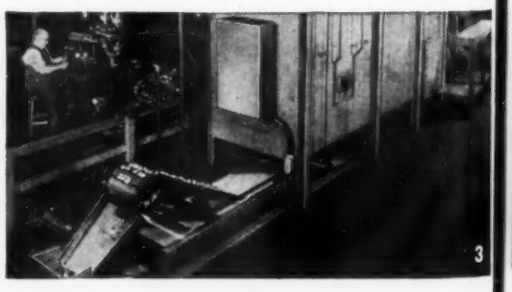
Collets and Feed Fingers for all makes of
Automatics, Chucking Machines and Turret Lathes

Worried about TOMORROW'S PRODUCTION ?

Find out today about EX-CELL-O's Complete Facilities for Manufacturing Parts and Sub-Assemblies

Leadership in developing advanced manufacturing methods . . . long years of engineering experience . . . modern and complete facilities . . . that have given Ex-Cell-O an outstanding record in production for war—*all these can help you solve the problem of mass production of accurate parts and sub-assemblies for your new or redesigned products.* Ex-Cell-O, with machining, heat-treating, grinding and assembling and inspection facilities *all under one management,* offers you many practical advantages. Send your print or part or sketch to Ex-Cell-O in Detroit today, or get in touch with any member of Ex-Cell-O's field engineering staff in 32 of the leading industrial centers in the United States and Canada.





EX-CELL-O CORPORATION

XLO
EX-CELL-O for PRECISION

EX-CELL-O's *facilities:*

PRODUCTION ENGINEERING

The Ex-Cell-O organization, with skill, facilities and modern methods that have made a wartime record, can make an important contribution in the planning of quantity production of quality parts and unit assemblies for your postwar product.

HEAT TREAT

Induction Hearing
Laboratory for Heat Treat Control including Micro Examination and Photography
Atmosphere Control Continuous Hardening Furnaces
Atmosphere Control Box Hardening Furnaces
Various Types of Air-Draw Batch Type Furnaces
Gas Carburize Furnaces
Box Carburize Furnaces
Pack Anneal Furnaces
Nitriding Furnaces
Cyanide, Lead, and Neutral Salt Pot Furnaces
High Speed Steel Atmosphere Control
Vertical and Horizontal Hardening Furnaces
Continuous Air-Draw Furnaces
Sub-Zero Heat Treating Equipment

PRODUCTION MACHINES

Multiple Vertical Turret Lathes
Multiple Spindle Automatic Screw Machines
Single Spindle Automatic Screw Machines
Hand Screw Machines
Centerless Grinders
Single and Multiple Spindle Drilling Equipment
Plain O.D. Grinders
Plain I.D. Grinders
Milling Machines
Broaching Machines
Precision Thread Grinders
Precision Boring Machines
Lapping Machines
Special High Production Equipment

UNIT ASSEMBLIES

For many years Ex-Cell-O has supplied large and small manufacturers with parts and has also supplied many parts in unit assemblies after machining, heat treating and grinding.

INSPECTION

Ex-Cell-O has always maintained that quality in a product is not the result of accident, that quality is built into a product by rigid adherence to accepted quality standards . . . standards that are upheld at Ex-Cell-O by constant inspection at every step of the machining process.

To left: **If you do not now receive Ex-Cell-O TOOL TIPS, devoted to precision, speed and economy in production, send your name, company, address and position to Ex-Cell-O Corporation, 1200 Oakman Boulevard, Detroit 6, Michigan.**

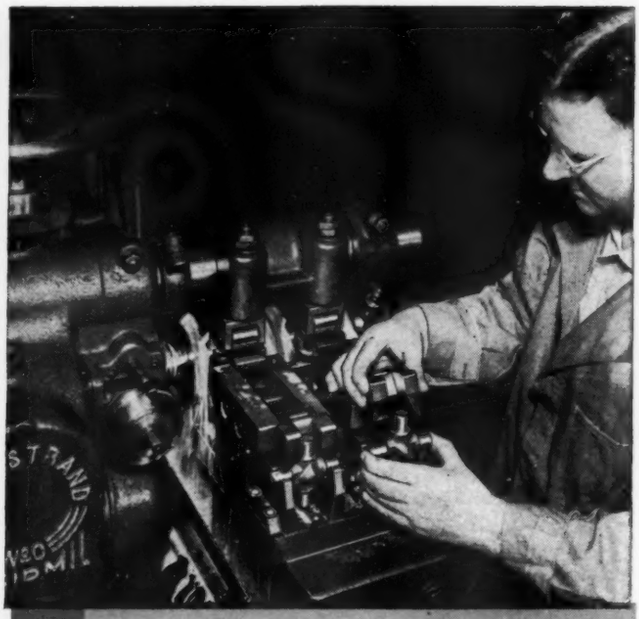
Illustrations below: **A few miscellaneous views of some Ex-Cell-O heat treat facilities, considered among the most modern and complete in American Industry.**

4

5

DETROIT 6, MICH.

HOW SUNDSTRAND ENGINEERED PRODUCTION WILL IMPROVE YOUR MILLING METHODS



ONE OF THESE 3 METHODS WILL BE MOST ECONOMICAL FOR YOUR PRODUCTION MILLING JOB...

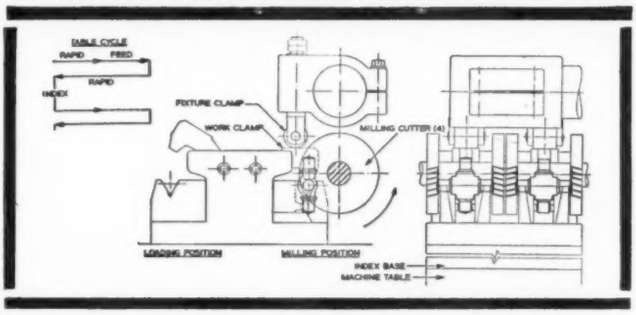
Experienced and progressive process engineers always strive to solve their metal-working production problems with a minimum of equipment. In the event that standard machines cannot be applied "as-is", information is sought on standard machines that can be readily supplied with special heads and fixtures to suit the job at hand. In many cases, however, where production quantities warrant, and the application of standard equipment is impractical, entirely special machines are used.

The following is a brief resume of the complete engineering and manufacturing service available from Sundstrand to meet all or any of your production milling requirements in small and medium size work.

These actual examples from field applications are presented to reveal one of each of the methods used in solving milling production problems. One of these methods may be the solution to your present problem.

HERE ARE THE 3 METHODS

1 STANDARD RIGIDMILLS WITH FIXTURES AND TOOLING TO SUIT YOUR WORK

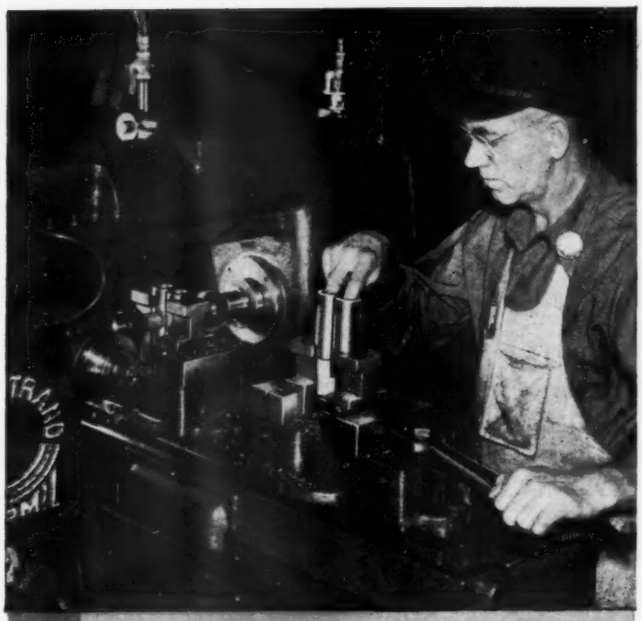


Here's an excellent example of economical milling production: standard No. 0 Rigidmil provided with special fixture holding two universal joint spiders side by side. Entire fixture is mounted on a standard automatic index base. The index base is arranged for 180° index making it possible to load and unload parts while milling. Milling ends is completely automatic. Cycle of machine table and fixture indexing is automatically controlled by table dogs.

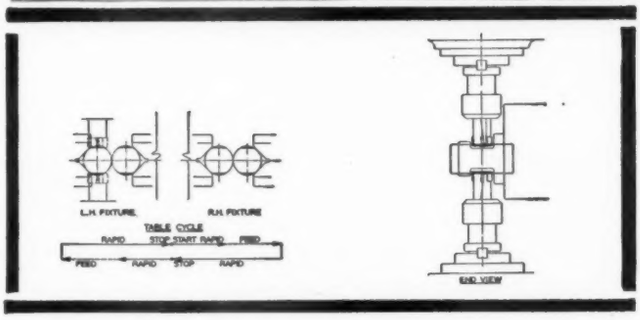
The Sundstrand automatic index base has been used often to increase production, improve accuracy and eliminate manual indexing. Its design permits heavy cuts without disturbing accuracy and increases production through eliminating loading time.

SUNDSTRAND MACHINE TOOL CO. ROCKFORD ILLINOIS U.S.A.

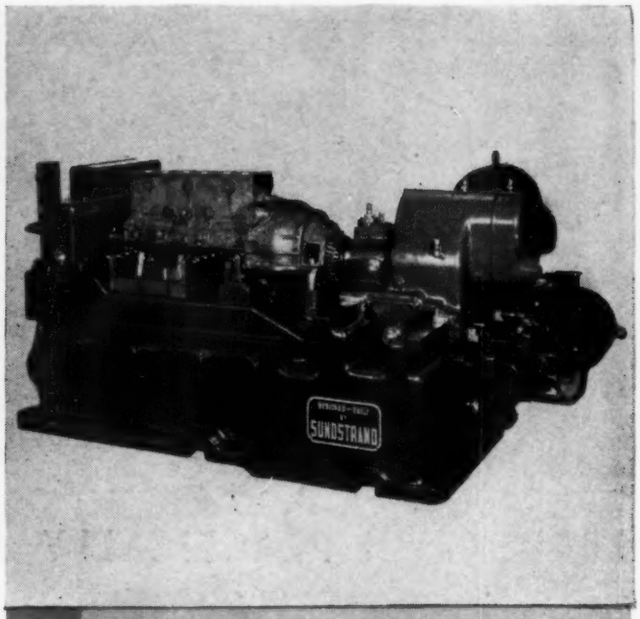
RIGIDMILS | FLUID-SCREW RIGIDMILS | AUTOMATIC LATHES | HYDRAULIC EQUIPMENT



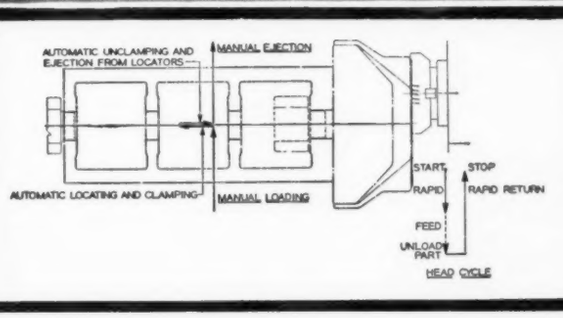
2 RIGIDMILLS WITH SPECIAL HEADS AND TOOLING



Milling opposed flats on oil well sucker tube couplings on a standard No. 1 Hydraulic Rigidmil provided with a standard horizontal head. Mounted in an opposed direction is an attached head which makes possible the simultaneous milling of both flats on the coupling. The attached head is driven from the standard spindle and can be removed to accommodate other milling operations.



3 ENTIRELY SPECIAL MACHINES



Special Sundstrand machine finish mills end of cylinder block and flywheel housing assembly. Machine incorporates a special traveling head and automatic locating and clamping device. End pad is machined absolutely square with the bore in the main bearings — with an extremely high degree of finish.

more proof

FREE

More proof of the successful application of Sundstrand "engineered" milling production is contained in this new book. Over 60 problem solutions complete with tooling diagrams are included. Write for your copy today. Ask for bulletin No. 144.

SUNDSTRAND MACHINE TOOL CO. ROCKFORD ILLINOIS U.S.A.

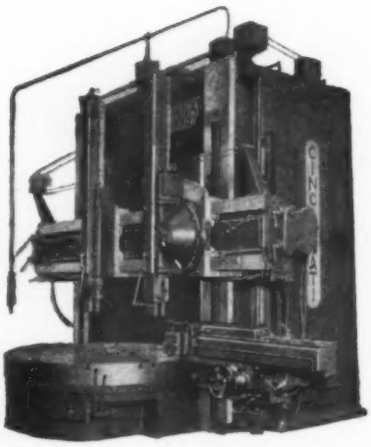
SUNDSTRAND

MACHINE TOOL COMPANY

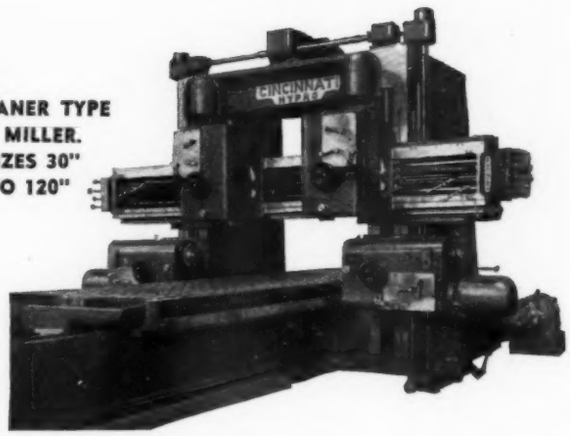
2533 Eleventh St. • Rockford, Ill., U.S.A.

DRILLING AND CENTERING MACHINES

SPECIAL MILLING AND TURNING MACHINES



VERTICAL BORING MILL. SIZES: 54" to 12'



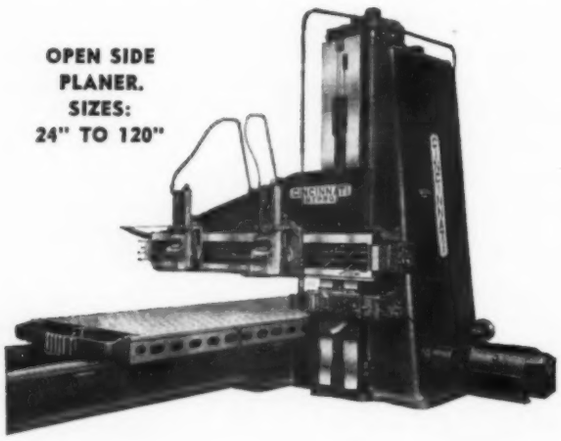
PLANER TYPE MILLER. SIZES 30" TO 120"

LEADERS IN PRACTICALLY ALL INDUSTRIAL FIELDS USE

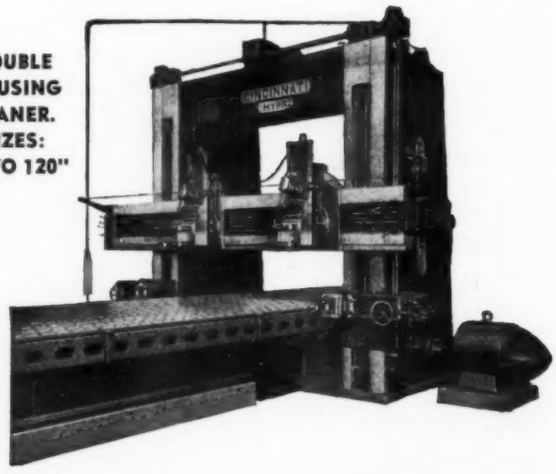
CINCINNATI HYPRO MACHINES

For new versatility, ease of control, highest speeds and extreme accuracy, consider a new Cincinnati Hypro for your post-war production problems.

ENGINEERED TO MEET TOMORROW'S NEEDS FOR HIGH PRODUCTION



OPEN SIDE PLANER. SIZES: 24" TO 120"



DOUBLE HOUSING PLANER. SIZES: 24" TO 120"

THE CINCINNATI HYPRO PLANER COMPANY

PLANERS · BORING MILLS · PLANER TYPE MILLERS

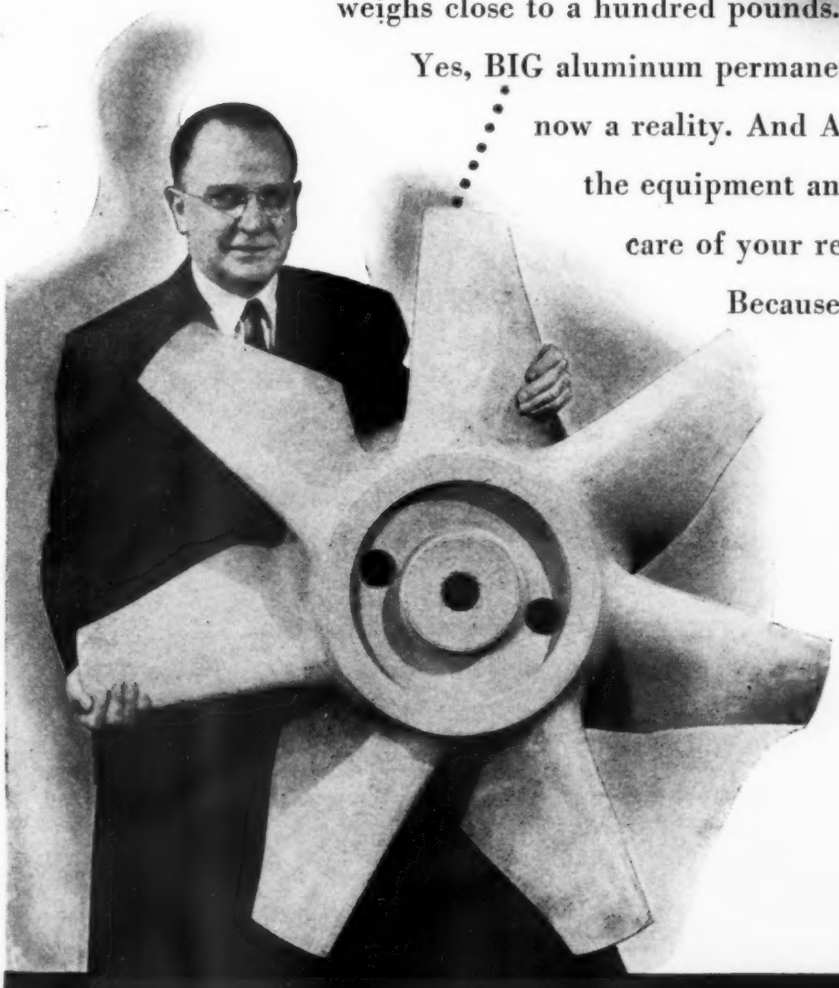
CINCINNATI, OHIO

The hat trick was a good one, but ...

Alcoa Aluminum Permanent-Mold Castings long ago outgrew the "small" category

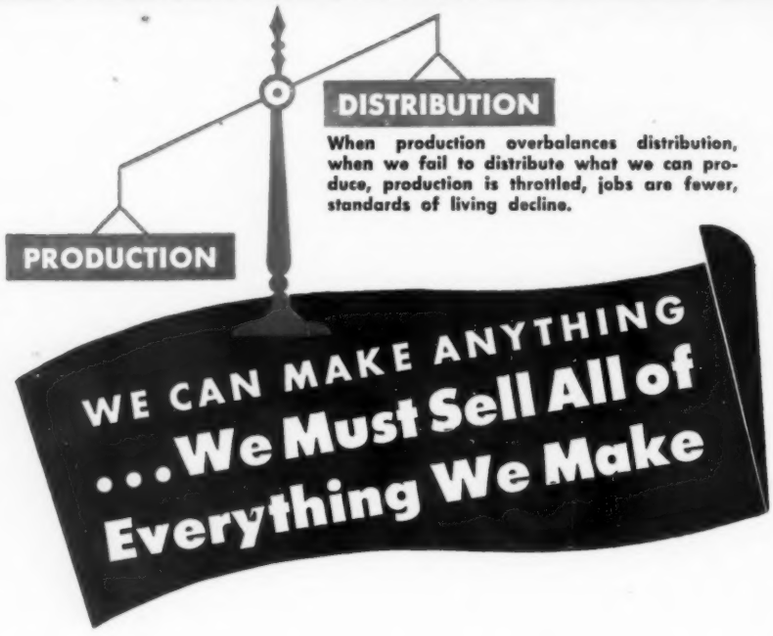
Do you still think of permanent-mold castings as "small enough to put in a derby hat?" The war changed that. The blower impeller shown here is typical of products made by this process. It weighs close to a hundred pounds.

Yes, BIG aluminum permanent-mold castings are now a reality. And Alcoa has the know-how, the equipment and the capacity for taking care of your requirements.



Because Alcoa permanent-mold castings carry little excess metal, they cut down finishing time and help speed your production. Aluminum Company of America, 2107 Gulf Building, Pittsburgh 19, Pennsylvania.

FIRST IN **ALCOA ALUMINUM**


DISTRIBUTION
When production overbalances distribution, when we fail to distribute what we can produce, production is throttled, jobs are fewer, standards of living decline.
PRODUCTION
WE CAN MAKE ANYTHING
...We Must Sell All of
Everything We Make

For a long time we in America have derived great comfort and assurance from the knowledge that we have the industrial ability to produce anything we may need or want. We have tied our wagon to the bright star of producing more products at higher wages to sell at lower prices.

This concept of production has brought us the largest expansion in a standard of living of any people in history.

But, while we have always been able to make anything, we have not always been able to sell all of everything we could make. We have not devoted the same enterprising energy to expanding distribution that we have to production. So, in the past, for immediate short swing relief we have resorted to government imposed restrictions on production and distribution. This expedient did not bring worth-while relief, for in the end it added up to fewer jobs, less production—higher prices.

If commerce and industry will use its inspirational ability and ingenuity to find better, cheaper methods of distribution per unit our goal of full employment may easily be accomplished and we can return to the enviable position of enjoying an expanding standard of living.

MICROMATIC HONE CORPORATION
DETROIT 4, MICHIGAN

MODEL 705

THESE MACHINES HAVE HELPED BRING VAST IMPROVEMENT IN WAR "DISTRIBUTION" VEHICLES . . . . . .

...they will do THE SAME for Distribution in Peacetime

MODEL 702

While cost is a secondary consideration in distribution of war materials, other needs parallel peacetime distribution. Lighter, more easily operated equipment—higher pay loads—easier maintenance, and less of it—are all vital. Micromatic Honing machines have helped wartime distribution to these goals—will do the same for industry after the war. At the same time they will help lower initial and operating costs of distribution machinery—lower costs of goods delivered.

MODEL 705

VERTICAL HYDROHONER

Micromatic Model 705 Multiple Spindle Vertical Hydrohoner has built-in automatic Microsize Control which gauges work automatically—holds within tolerance of .0001" for geometric accuracy and .0003" for *uniform diameter size*—automatically stops honing cycle when correct size is reached. For internal honing or bores ¼" to 2" diameter. Rotary indexing work fixture provides high production. Usually recommended for maximum stock removal ranging from .0005" to .0015" on hardened parts—.001" to .010" on soft or medium hard. (Illustrated above, left).

Precision sphericity without measurable error is generated on ball studs by the Micromatic Ball Stud Honer.

Removes .030" stock on diameter from turned heat treated forgings.

Precision honing of long pieces—external or internal—is the work of the Micromatic Horizontal Floor Type Honer. Either hydraulic or manual control or tools. Set-ups available to generate either cross-hatch or co-directional finish patterns.

MODEL 702 Single Spindle Type HYDROHONER

Single Spindle Type Micromatic Hydrohoner Model 702 for rapid production honing of bores or cylindrical surfaces up to 2" in diameter. (Illustrated above, right).

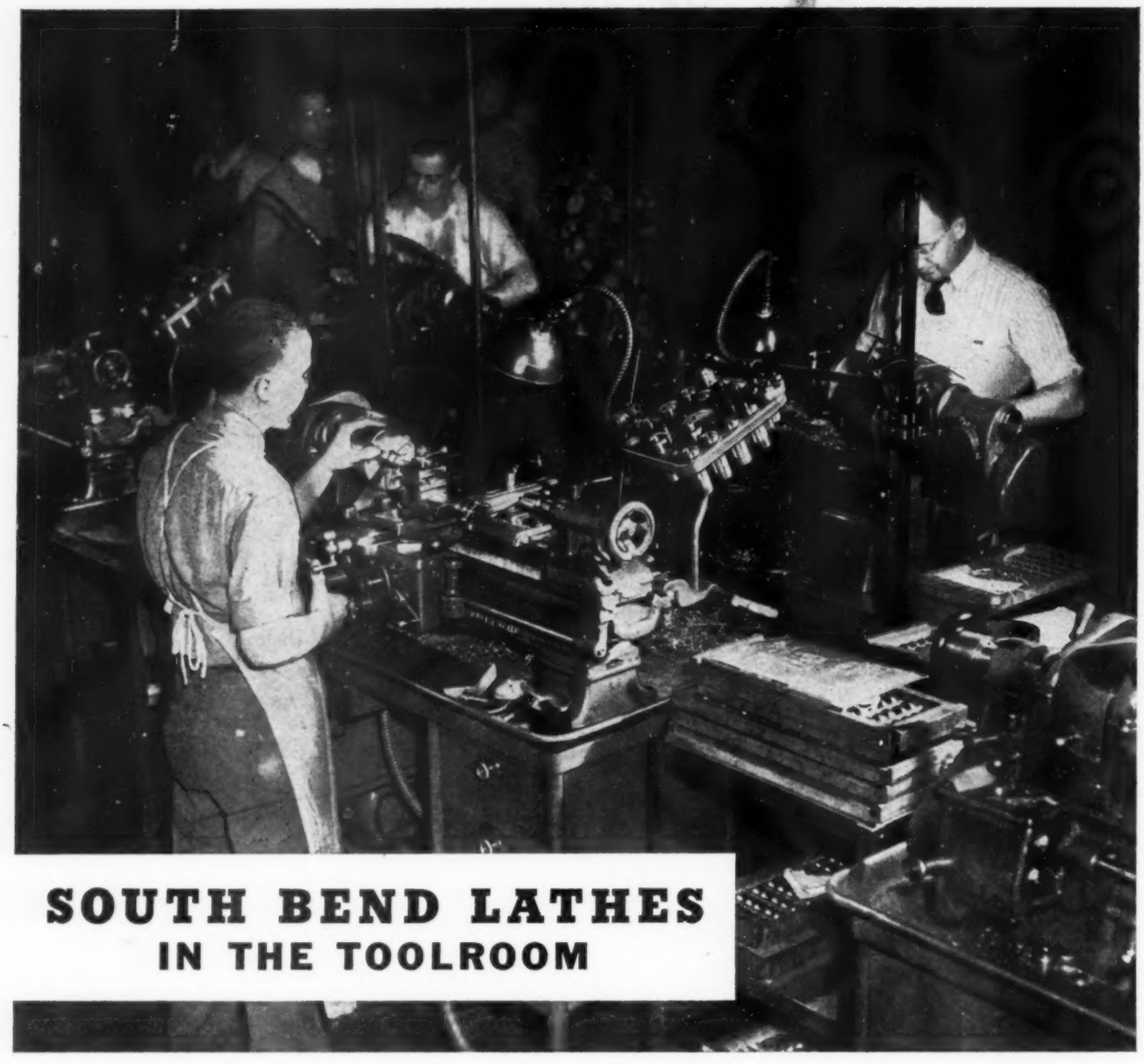
Silver plated bearings are production honed on a Micromatic Horizontal. Costs were reduced 50% from previous methods.

MICROMATIC HONE CORPORATION

DETROIT 4, MICHIGAN

DISTRICT OFFICES: 614 Empire Building, 206 South Main Street, Rockford, Illinois • 129 Church Street, New Haven 10, Connecticut
501 Harries Building, 137 North Main Street, Dayton, Ohio • 1031 South Broadway, Los Angeles 15, California

MAKERS OF HONING MACHINE TOOLS



SOUTH BEND LATHES
IN THE TOOLROOM

WHERE PRECISION AND PERFORMANCE COUNT!

COLLETS FOR SOUTH BEND LATHES
are available from 1/16" to 1" capacity in 1/64" steps. A complete set will help to lower your toolroom costs.

Nowhere in the plant are unfailing precision and dependable performance more important than in the toolroom. It is here—in the "tools that make the tools"—that the quality and cost of the product are largely pre-determined.

The ability of South Bend Lathes to perform a wide variety of precision operations makes them the most valuable and versatile tools in the toolroom. The ease and speed with which they can be changed from one set-up to another is a definite advantage and still another reason for their wide popularity. A complete line of attachments and accessories are available which will simplify your tooling still further. Write today for Catalog 100-D which illustrates in full color and completely describes the complete line of South Bend Engine Lathes, Toolroom Lathes and Turret Lathes.

SOUTH BEND LATHE WORKS
419 EAST MADISON STREET • • SOUTH BEND 22, INDIANA
LATHE BUILDERS SINCE 1906

VERS-O-TOOL*

Forming cuts are taken on all four arms of this differential trunion—*simultaneously*—to produce 225 pieces per hour. That's *production!*

Operating with spindle speeds of 400 rpm and a feed of .010″, these Vers-o-tools finish each forging to the same close tolerances, hour after hour.

Whether you're threading, end turning, end forming, knurling, burnishing or performing a combination of these operations, circular ground chasers and circular cutters are accurate to the original limits for every regrind.

By using duplicate sets, substituted in less than one minute and without disturbing the setup, you put responsibility for accurate cutting edges in the toolroom, where it belongs. There's no sacrifice of operator's time—no "cutting and trying". You'll save both time and material.

Standard circular chasers and cutters may be reground through 270° circumference. Instead of one cutting edge there are four; cutters do their work three times faster.

Be sure you have complete, up-to-date information. Ask for catalog D-42-C.

*Vers-o-tools are heads, either revolving or stationary, self-opening or hand-operated, that hold circular thread chasers or circular cutters to the work. They are built in a wide variety of sizes and types, and—as the name implies—are extremely versatile in application to many different types of jobs through the use of interchangeable chasers or cutters.

The NATIONAL ACME CO.

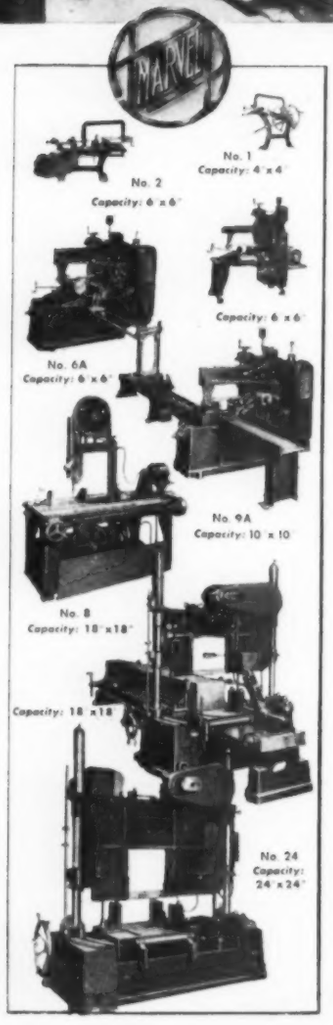
170 EAST 131st STREET • CLEVELAND 8, OHIO

Acme-Gridley 4-6 and 8 Spindle Bar and Chucking Automatics • Single Spindle Automatics • Automatic Threading Dies and Taps • The Chronolog • Limit, Motor Starter and Control Station Switches • Solenoids Centrifuges • Contract Manufacturing

RAILWAYS ARE *Streamlining* THEIR SHOPS TOO!

(ABOVE) MARVEL No. 9A Production Saw automatically cutting-off hollow iron into staybolts; 1" x 9", 30 bolts to the cut.

(LEFT) Cutting accurate lengths from 3½" steel tubing for spring and brake hanger bushings.



Railway shops are "re-converting", not to new products but to newer and more efficient methods.

Today, in the Paducah shops of the Illinois Central, for example, much cutting-off work is being done with MARVEL No. 9A Production Saws that feed, measure and cut off identical lengths automatically with no more operator attention than is required by an automatic screw machine.

Operating "automatically", the MARVEL No. 9A Saw illustrated above has cut-off as many as 300 pieces of 1" round staybolt stock in a single hour. Supervision at the Paducah shops tell us that the machine paid for itself in the first 30 days and has been piling up dividends ever since. These extremely accurate and fast saws are not limited to production cutting-off work, because at any point in a "run", the automatic bar push-up can be dis-engaged, a miscellaneous cut made, and the production run resumed by merely re-engaging the bar push-up clutch.

The MARVEL System of Metal Sawing comprises 9 different *types* of metal-cutting saws; provides the complete answer to most metal sawing problems.

ARMSTRONG-BLUM MFG. CO.

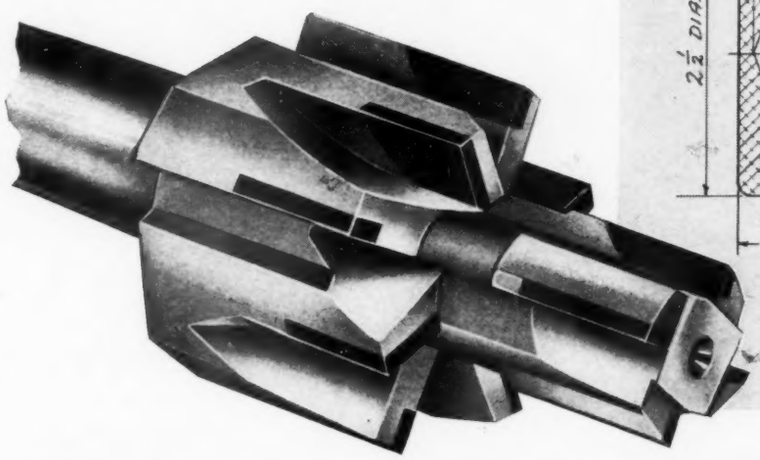
"The Hack Saw People"

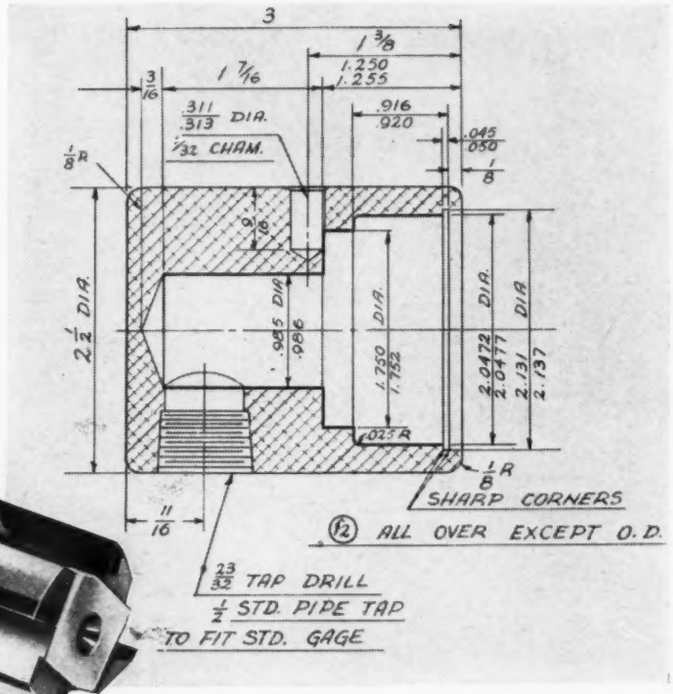
5700 Bloomingdale Avenue **Chicago 39, U. S. A.**

***Eastern Sales Office:* 225 Lafayette St., New York 12, N. Y.**

MARVEL SAWS

Three-diameter Staples Carboloy-tipped Combination Reamer, specially designed to meet the requirements of this close tolerance operation.





Staples CARBOLOY-TIPPED CEMENTED CARBIDES SPECIAL TOOLS

SPEED THE JOB TO FINER PRECISION

Ream two or more diameters simultaneously with a Staples Carboloy-tipped Special Tool, and you save important time and costs. But, more important—you achieve an exceptional all-over precision and closer tolerances.

Staples superiority is the result of diamond lapping of Carboloy Cemented Carbide tips, copper brazed to steel for braze strength, and the fine grinding of flutes for free passage of chips. Uniform excellence of diamond ground cutting surfaces means many more pieces before regrinding.

Any job that justifies a special tool is entitled to no less than Staples Tool precision.

Staples Special Tools and the line of Staples Standard Tools are widely used in American Industry . . . where stepped-up reconversion activities call for faster operations and the highest quality.

THE STAPLES TOOL COMPANY

Formerly Staples Tool & Engineering Company

CINCINNATI 25 **OHIO**

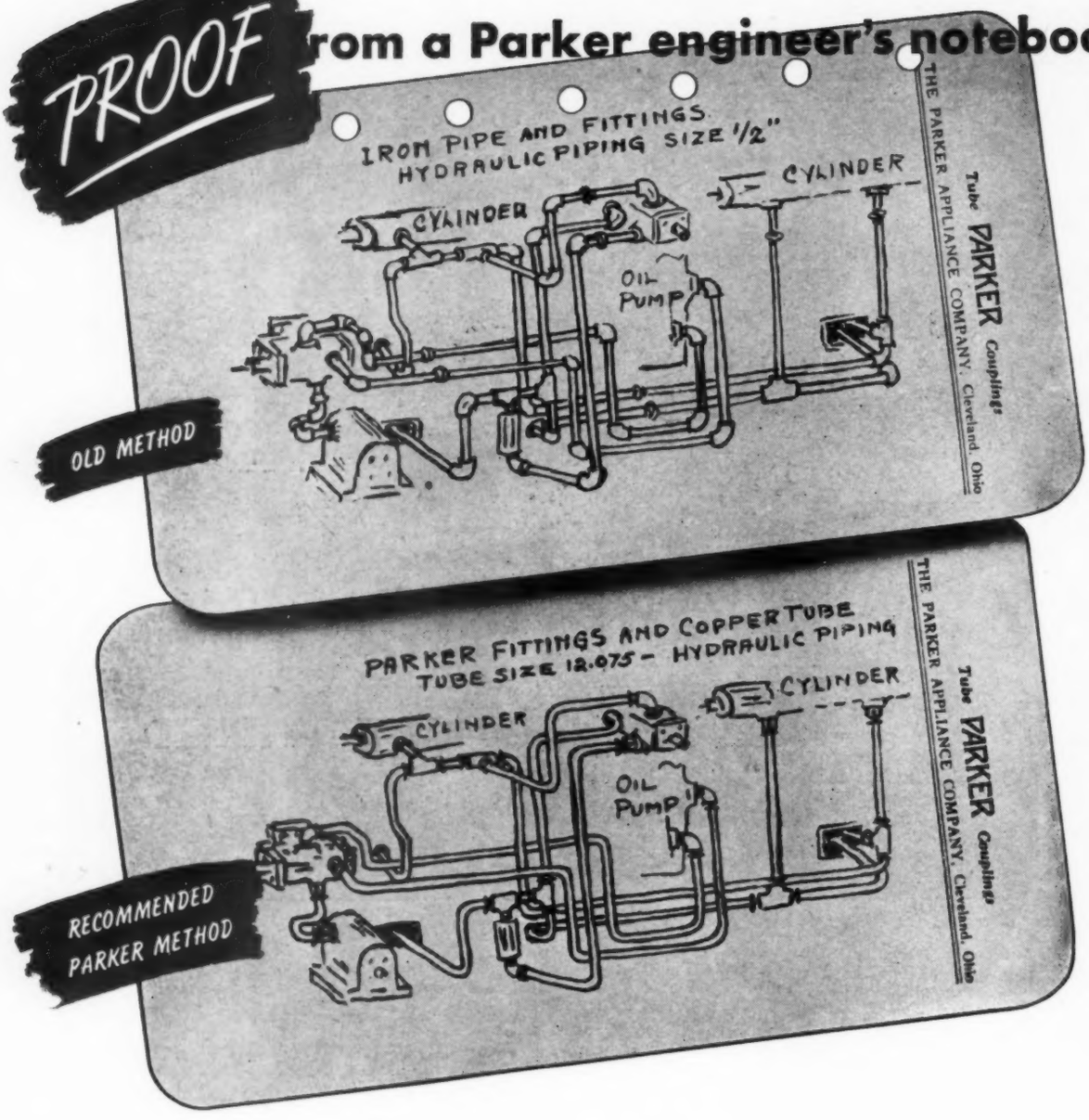
WHATEVER YOUR MACHINING PROBLEM

— however complex — Staples Special Tool engineering facilities will help you solve it.

Staples CARBOLOY-TIPPED CIRCULAR CUTTING TOOLS

REAMERS • CORE DRILLS • SPOT FACERS • COUNTERBORES • END MILLS • SHELL END MILLS • ALSO A COMPLETE LINE OF CIRCULAR SPECIAL TOOLS

PROOF from a Parker engineer's notebook



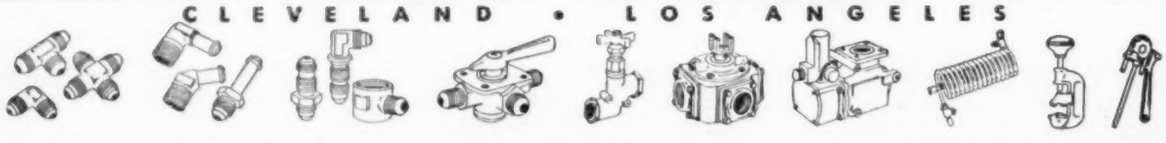
Advantages of Parker Recommendation

- Streamlined flow, free from obstructions. No sharp turns and pockets to cause turbulence. Less pressure drop; capacity and pressure requirements reduced.
- Fewer joints and connections—to reduce leakage, even under high pressure, vibration, shock, fluid hammer, surge or accidental abuse.
- Compact, spacesaving, neat and simplified installation, especially in tight places—yet all parts are accessible for quick, easy installation and service.

We've engineered Fluid Power installations for many people—to bring them these advantages, under a wide range of exacting conditions. May we do the same for you? Let's talk it over.

THE PARKER APPLIANCE CO.

CLEVELAND • LOS ANGELES



FLUID POWER PRODUCTS FOR ALL INDUSTRY

Turn your difficult milling problems into routine production jobs

NEWTON SPECIAL RAM TYPE MILLING MACHINE

Among Heavy Machine Tools built by Consolidated are . . . .

LATHES
BORING MILLS
DRILL PRESSES
MILLING MACHINES
BORING MACHINES
COLD SAW MACHINES
PLANERS
SLOTTERS
RAILROAD SHOP TOOLS
AUTOMOTIVE TOOLS
AND OTHER
SPECIAL MACHINES

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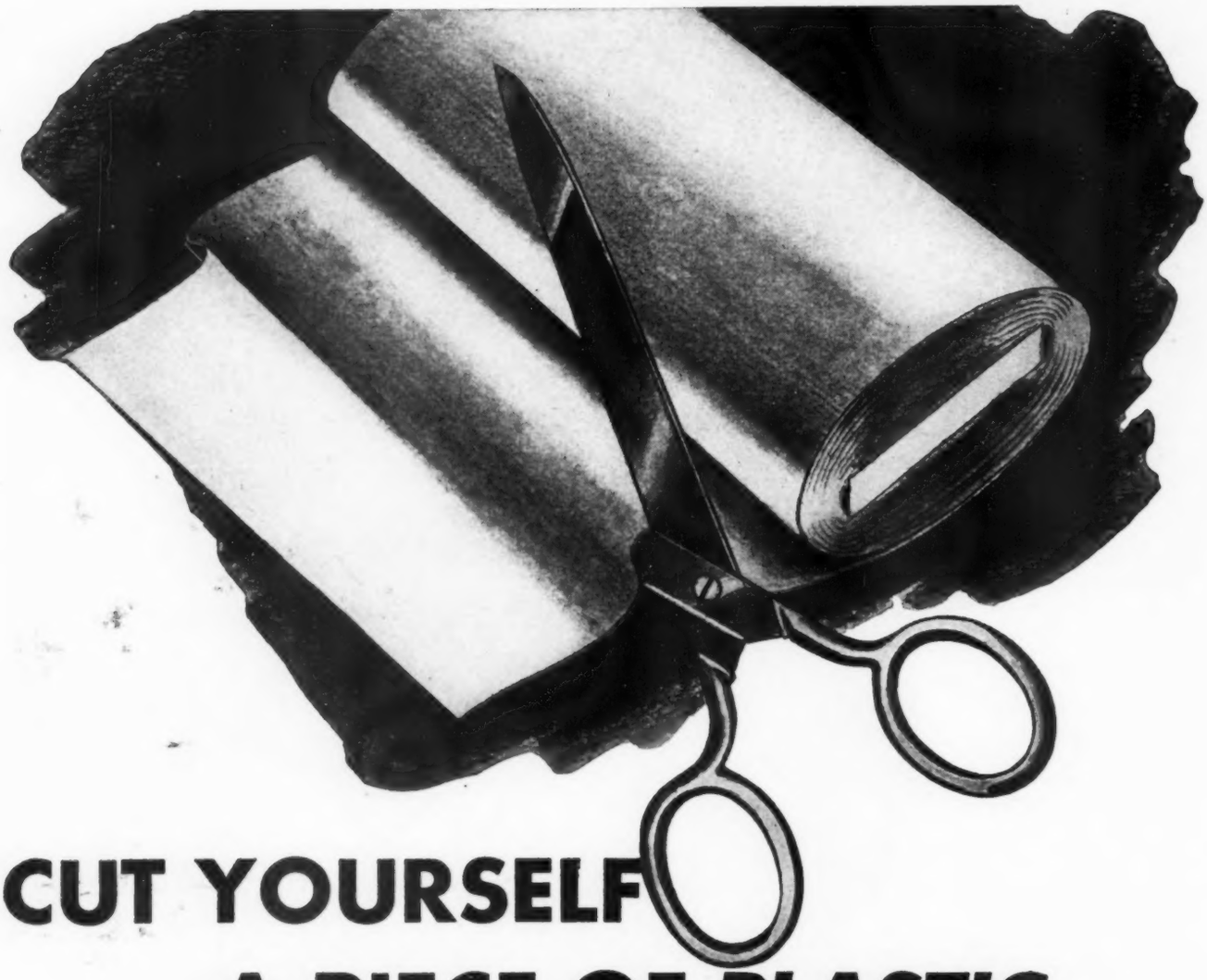

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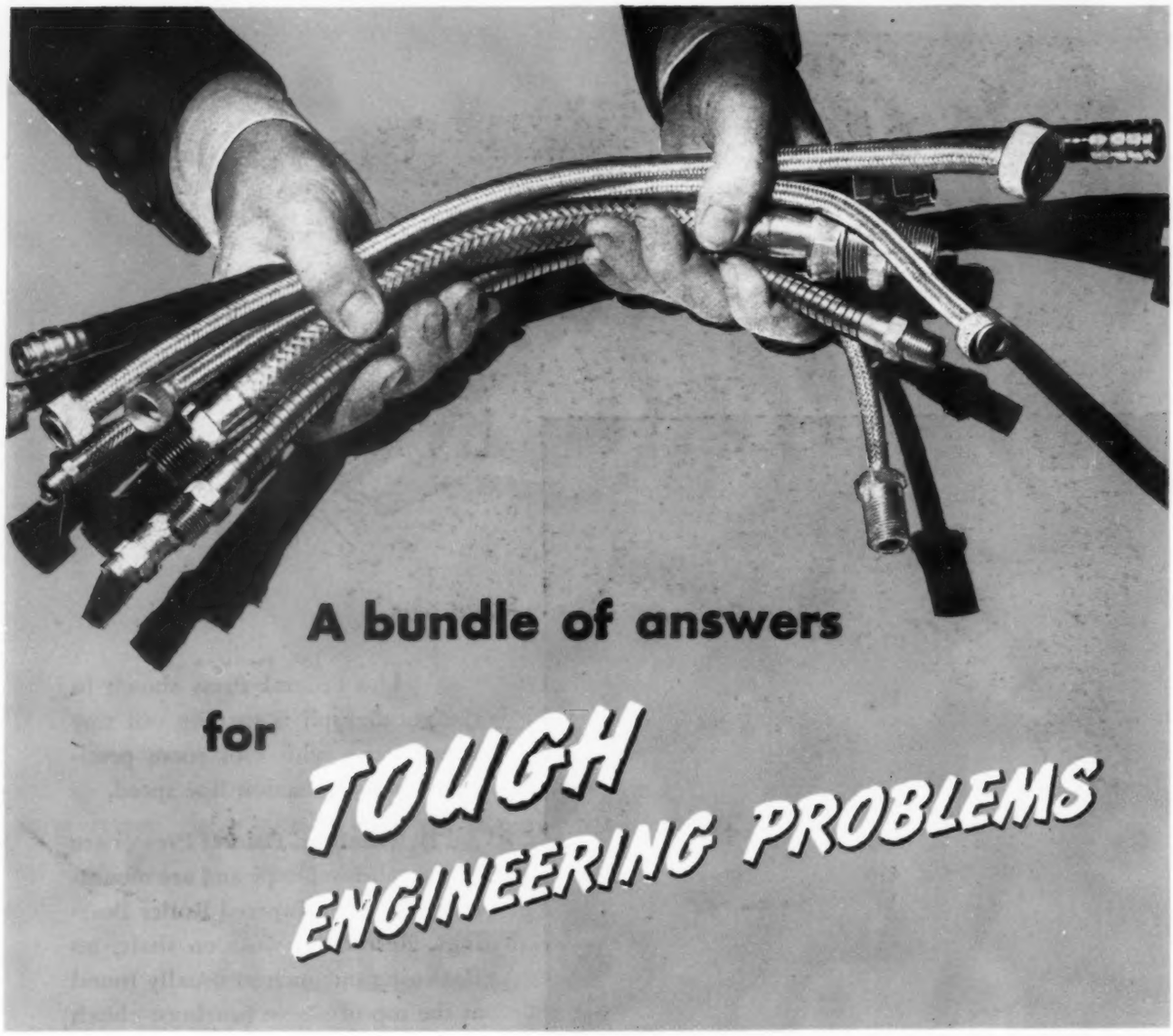

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Factories, mills, and other industrial plants all over the country are finding important new uses for G-E refrigeration: Cooling mill rolls . . . cooling quenching oils . . . seasoning castings . . . anodizing aluminum—these are just a few of the many operations saving time and money through refrigeration.

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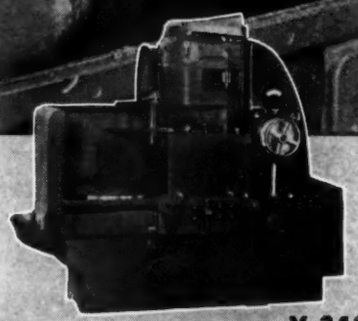

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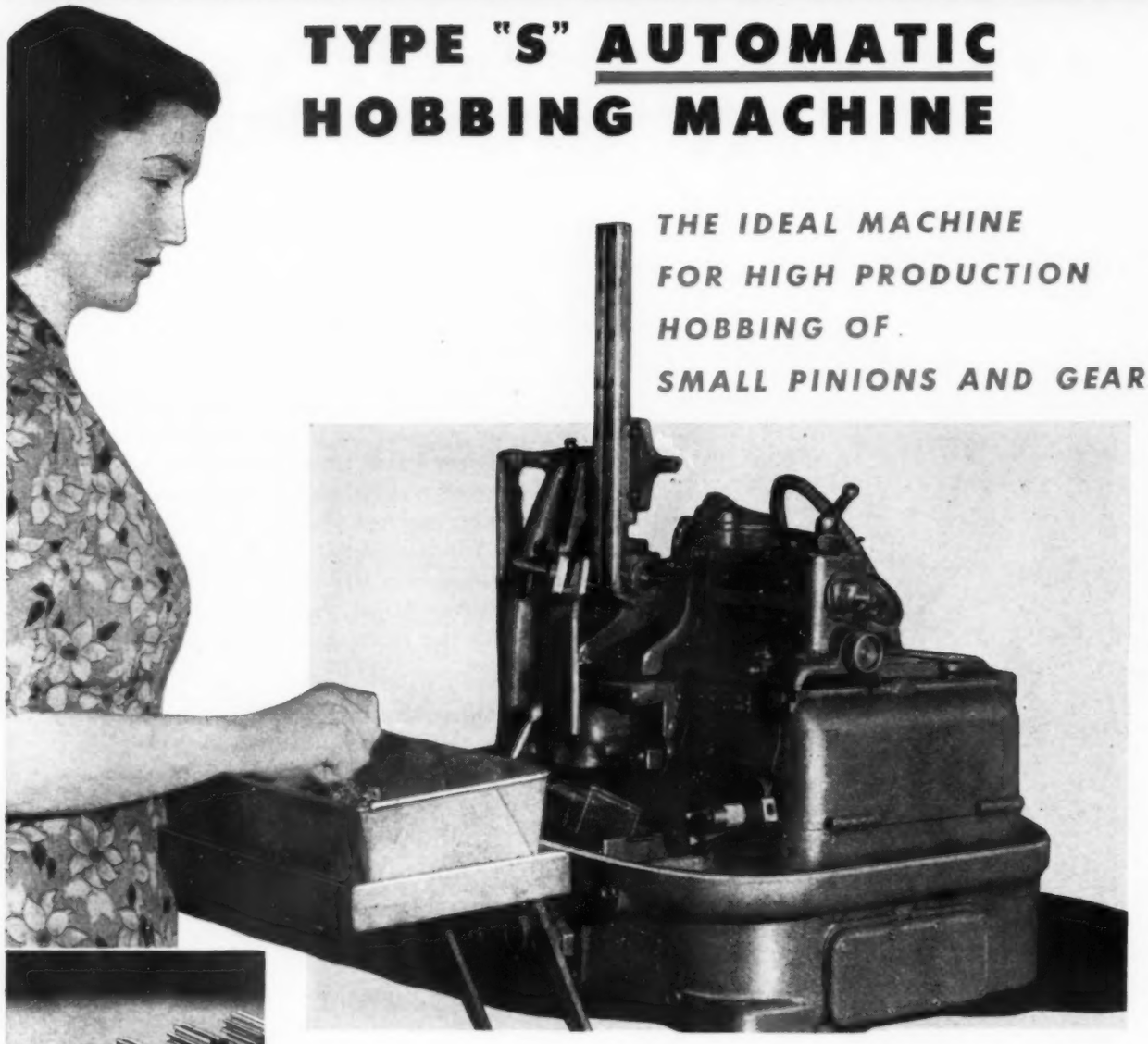

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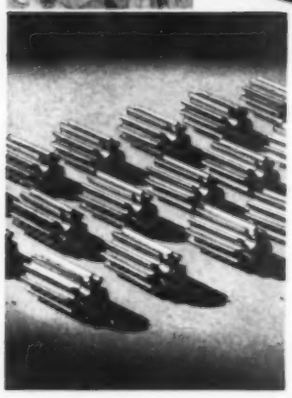

Pinions for clocks, instruments, timers, small speed reducers, light machines, small motors, and many other light-duty mechanisms can be made *fast and accurately* on the Barber-Colman type "S" Automatic Hobbing Machine. For example, the machine shown above is hobbing 10 teeth of 48-pitch clock form on free-turning brass rod blanks .440" long and .249" O.D. at the rate of *240 pieces an hour*. In this customer's plant, 11 Type "S" machines with 12-sec. cycles and 2 with 19-sec. cycles are producing a total of 290,000 pieces every week (working two 8-hour shifts, six days). Write today for our bulletin on the Type "S" Automatic Hobbing Machine and see how it can *improve production and lower costs for you*. Ask for Bulletin F-1474.

BARBER-COLMAN COMPANY

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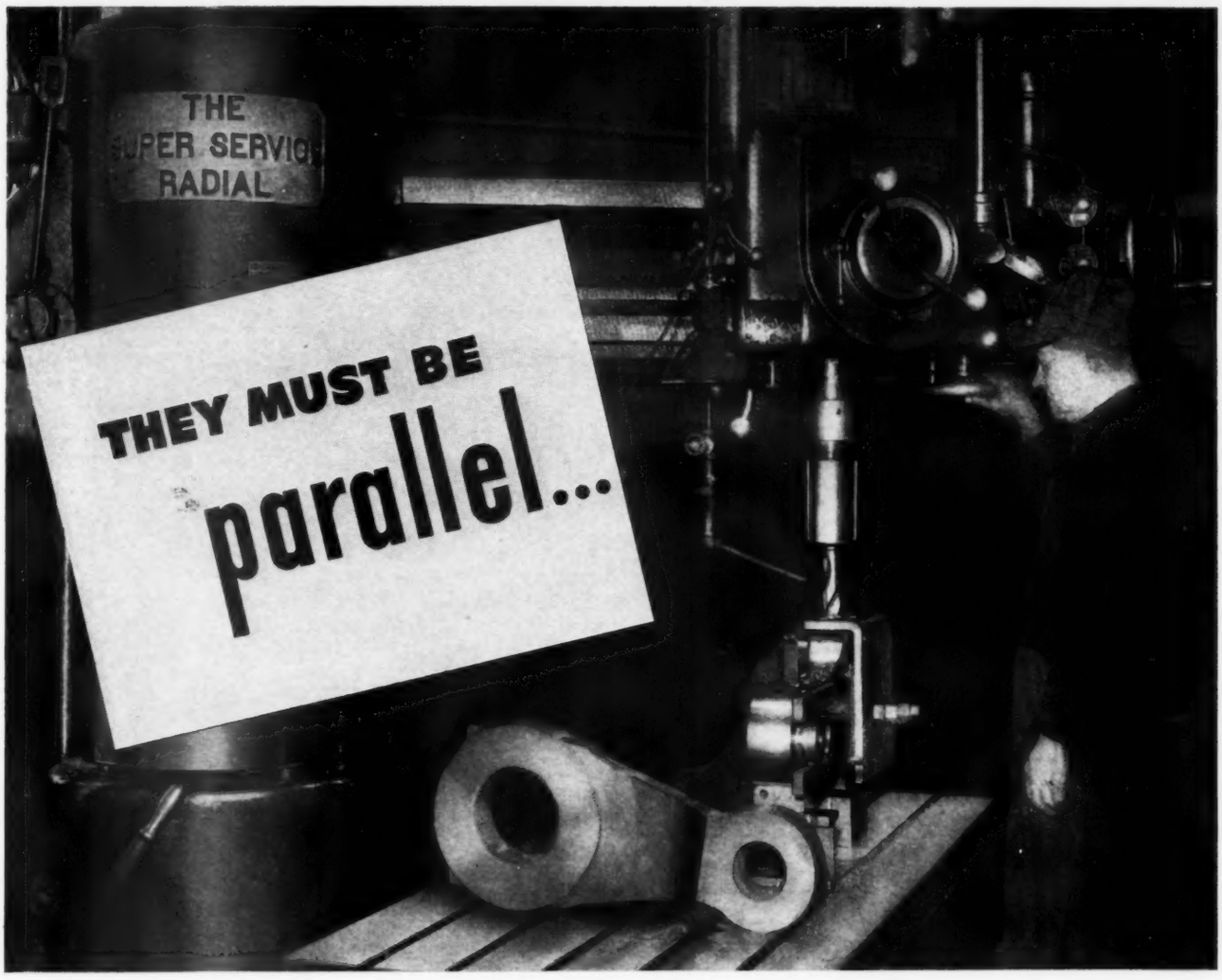

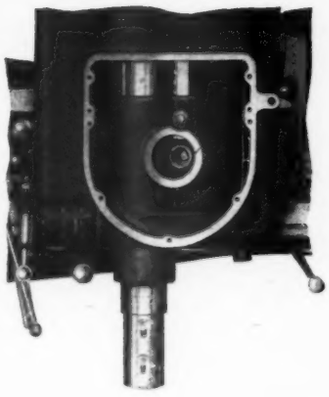

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See our Condensed Catalog in Sweet's File.

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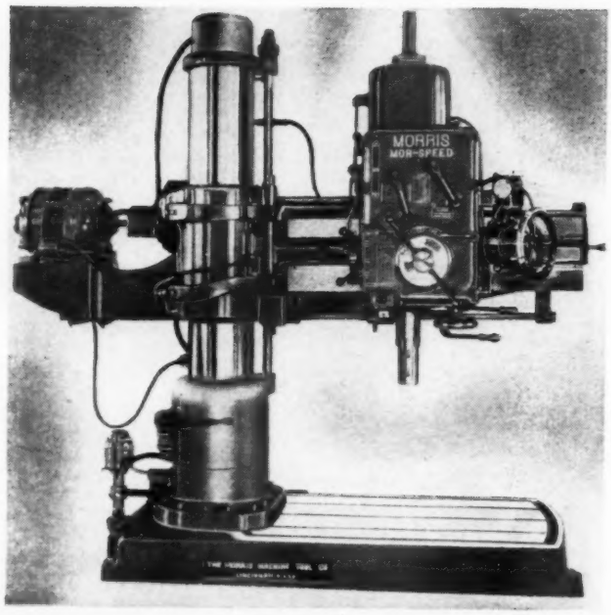
Morris has the "know how"—the engineering ability and the facilities to help you. Consult them on your Radial Drill work or on the mass production of work requiring drilling—reaming—boring—tapping and similar operations.



Builders of MOR-SPEED Radials

The MORRIS Machine Tool Co.

CINCINNATI 3, OHIO

Our Mechanical "Edge"

SOMEONE has said that we are a nation of mechanics. What he meant was that Americans appear to have more mechanical bent than other peoples.

Our ability to repair and improvise fighting equipment at the front, as well as our ingenuity in developing new war devices, were among the reasons why our forces moved unerringly toward victory. Our mechanical genius was put to good use in behalf of liberty.

At home, millions who previously had had no contact with industry learned to do some kind of factory work that helped to speed our cause. Though they may not have learned much, they are more familiar than before the war with how to make things.

Here then is a national asset not to be overlooked or neglected in laying out a program to meet a future emergency.

If it is important to have a well-trained and sizable military establishment, if it is essential to have at hand industrial facilities to supply the services with their needs, it is equally desirable to have in reserve an adequate force of trained personnel to man our factories.

As war becomes more mechanized, the relative value of the men on the industrial front multiplies. At the same time the men who maintain the weapons at the battlefront take on added responsibilities.

Our mechanical bent becomes more than a pleasant pastime or a stimulating asset in peacetime. It is part of our defense against any prospective foe.

On that basis, as well as because the growing mechanization of our peacetime economy demands it, we should give proper attention to training our youthful citizens to know more about mechanical things and how they work. We should encourage them to become adept at handling industrial machines.

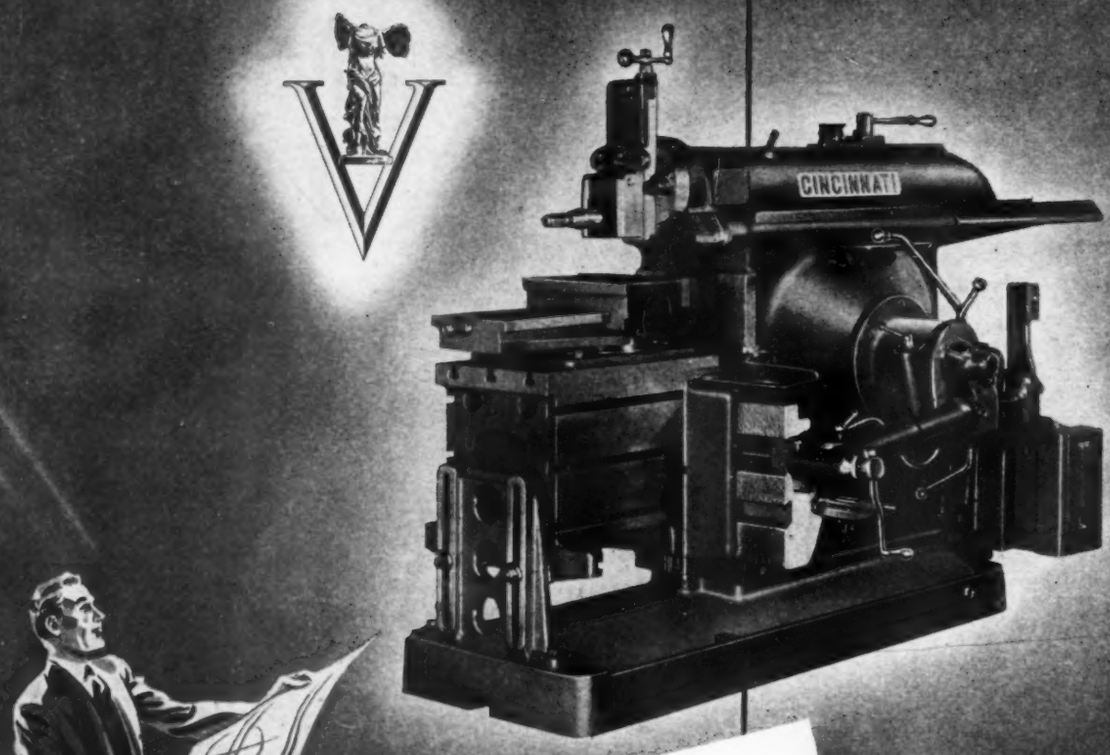
This suggestion is in no wise an appeal to make every youngster a mechanic instead of teaching him the humanities. We do believe, however, that it is time to take cognizance of our future needs in the mechanical line and arrange now to meet them instead of being overwhelmed by them when they suddenly become a reality.

Mechanical training should have a firm place in our future educational program. It should assume two forms. For one, if we enact on a national scale any form of compulsory military training, mechanical courses should be a part of the training. Again, the federal government should lend its prestige and financial help to promote on a larger scale than at present vocational education in America.

In an age of science, when all the world is moving rapidly toward industrialization and when other nations are eagerly acquiring from us our mechanical know-how, we cannot afford to lose the "edge" that we have possessed in recent years. It might well, at some future date, spell the difference between national survival and extinction.

Burnham Finney

Check Your CENTER of GRAVITY!



A Shaper is the center of gravity of the balanced tool room and die shop. Cincinnati Shapers are accurate, powerful, responsive. In batteries in the large plants, or singly in the small shop, Cincinnati Shapers give outstanding value

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THE CINCINNATI SHAPER CO.

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SHAPERS BRAKES SHEARS

How to Design Coils for Induction Heating

BY FRANK W. CURTIS, CONSULTING ENGINEER
· INDUCTION HEATING CORPORATION

Coil making is not limited to the winding of copper tubing in simple shapes but is an art that necessitates full consideration of the fundamental requirements

UPON the design of the inductor, usually referred to as the coil, depends the success of induction heating. The shape may vary from a single loop of copper tubing to a more involved assembly of copper strips, bus bars, jumpers and supports, depending upon the nature of the heating requirements. Constructional details are almost unlimited, and a wide variety of designs are available for different purposes.

Sometimes a heating operation can be tested with a temporary coil, after which a more permanent design can be adopted to carry out the desired heat pattern. In other cases, the heating needs may require a precision-type coil, so something better than an ordinary shape is essential. Often, a heating job is encountered where development work is required, for which several experimental coils may have to be constructed until the desired results are obtained. All in all, having available a variety of coil-design techniques from which to choose for a given need is most helpful.

For operations that require narrow heat patterns, such as might be needed for silver-alloy brazing of steel parts, coils made from a single turn of copper tubing or bus are used extensively. Such coils can be made in a variety of ways, and in Fig. 1 may be seen constructional features which

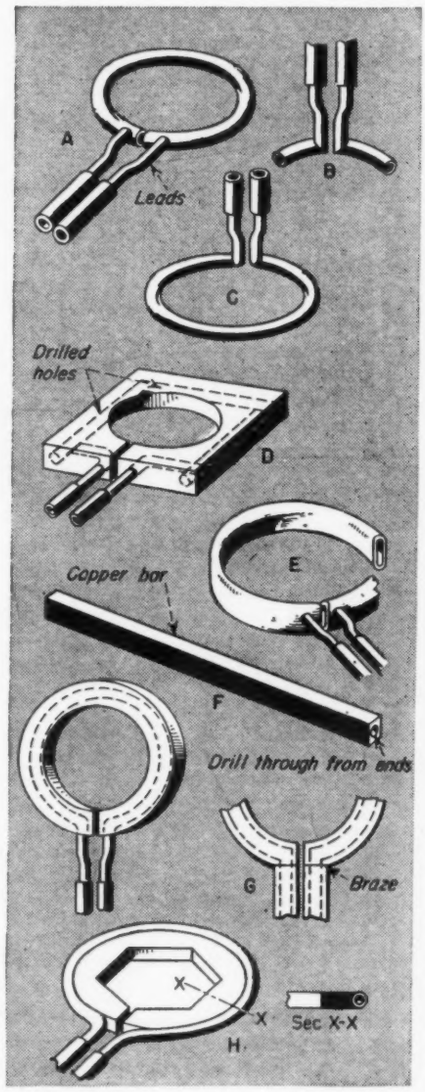


Fig. 1—These coils are made from single turns of tubing or bus bars for narrow heat patterns

can be applied in their design. The coil at *A* is a single loop of copper tubing, sealed at the ends by brass plugs, and then fitted with leads, brazed to the outside surface. Another way leads can be attached is illustrated at *B*, which includes mitered brazed joints. The same type of joint can be used when leads are brought up from the face of the coil, as at *C*. Solid-type single-turn coils, as shown at *D*, used for heating ferrous metals, serve the same purpose but are more durable and serve better for high-production purposes. They are made from a flat plate of copper, drilled with a series of holes for water passage, after which the openings are plugged to provide a continuous flow.

The coil at *E* is made from a section of Bourdon copper tubing, and fitted with brazed leads. Tubing in this shape offers a wide range of uses for coil construction. A convenient way to attach leads is to tap the holes in the coil and thread the connecting ends of the leads. This method provides a positive assembly, and holds the leads firmly in place during brazing. On 3/16-in. leads, for example, 10-32 threads can be used, and for ¼-in. tubing ¼-28 threads are used, and so on. Another form of single-turn coil can be made from a length of copper bus, drilled through from both ends, then heated and forged to shape, and machined, as shown at *F*. The leads can be made from tubing, or be of the solid type as shown at *G*. When it is necessary to provide a narrow coil for heating an irregular contour such as a cam or hex surface, the coil can be constructed as shown at *H*, in which the formed inductor is brazed on the inside of a copper tube, which in turn, provides the leads, as

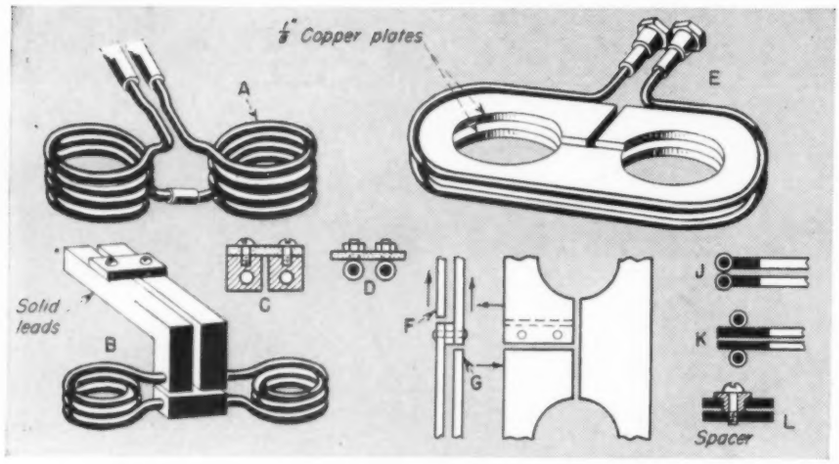


Fig. 2—Two or more pieces may be handled at once in series-wound multiple-turn coils

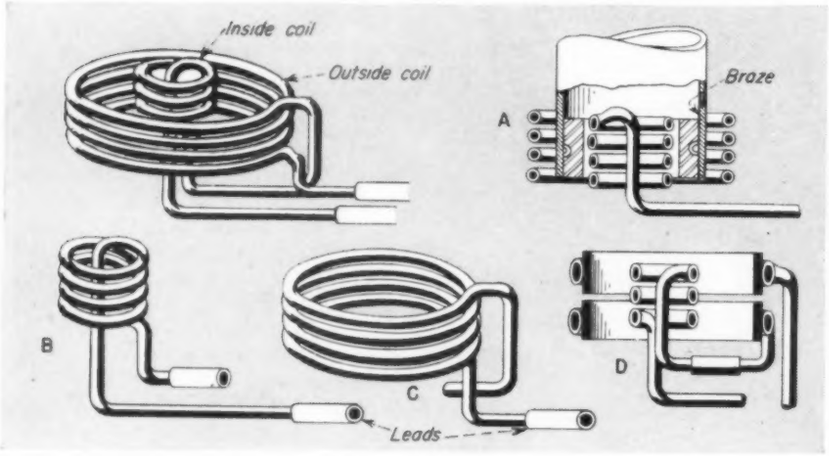


Fig. 3—Inside and outside heating may be combined in a number of ways; here are a few examples

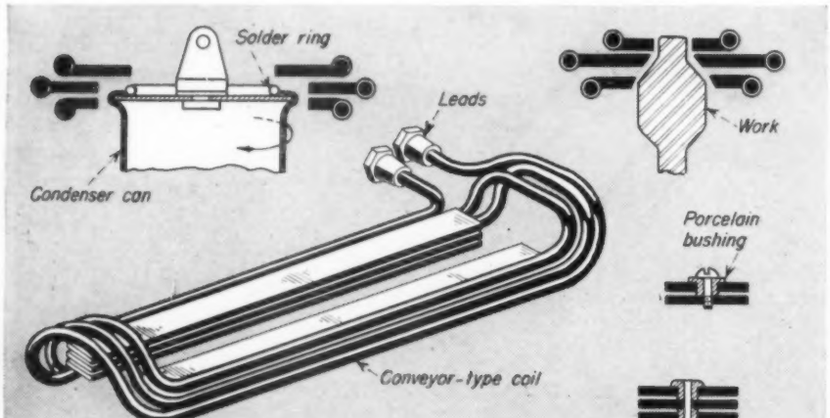


Fig. 4—Conveyor coils, such as these, are shaped to permit parts to be fed progressively through them

well as offering the necessary cooling.

Multi-turn coils can be arranged in series such as at *A*, Fig. 2, when two or more pieces are to be handled simultaneously, or where the part being treated has two or more surfaces to be heated. Solid-type leads can be used with such coils and arranged in the same way as the design at *B*. These leads are usually made from ½ or ¾-in. square copper bus sections, drilled for water passage and brazed together. Plastic supports can be attached to stiffen the assembly as at *C*. On leads made of copper tubing supports can also be applied, one method being shown at *D*, which comprises small brass studs brazed to the tubing, to which a small strip of plastic is mounted and held by brass nuts.

Another form of series coil is the design shown at *E*, made from copper plates, which would be termed a two-turn solid inductor. Copper tubing is used for the leads, and also surrounds the plates to provide cooling. The connections are made so that the high-frequency current enters at *F*, passes around the lower plate, then through the jumper to the upper plate and out at *G*, forming a continuous circuit, such as would be obtained from a series-type multi-turn copper tube coil. The usual practice is to attach the tubing to the plates as illustrated at *J* by brazing to the outside edges. An optional method is shown at *K*, with the tubing mounted on the flat sides of the plates. Spacers such as the small porcelain bushing shown at *L* can be used to insulate and hold the plates in correct relation to each other. On some types of coils made from plates, thin sheets of mica are used as shims to provide insulation and clearance.

Copper-tube coils can be made to combine inside and outside heating, as might be essential for silver brazing an assembly as illustrated at *A*, in Fig. 3. Details of the coil assembly are shown at the upper left. Such a coil can be made from a single length of tubing, using a wooden form for the necessary shaping and forming. A simpler method, however, is to make the inner and outer coils, *B* and *C*, separately, and then join them together. Many other forms of combination coils can be built up, such as the one at *D*, which has two heavy outer turns, with an inner coil series connected.

Through-Feed Coils

There are many forms of conveyor coils in use, the most common being made from several turns of copper tubing. These coils are so termed because they are shaped to permit parts to be fed progressively through them. For some applications, however, it becomes necessary to provide such a coil with two, three or more turns spaced within a narrow band, in which case the use of thin copper strips, in combination with copper tubing, as illustrated in Fig. 4, can be used. For example, using a 1/16-in. thickness, three turns could be confined to an area of about 5/16 in.,

which is often essential, especially when non-ferrous metals are heated.

With all the coil designs shown, many modifications and combinations can be considered, the main thought being always to provide adequate cooling, whether tubing or solid-type coils are to be used. Also it is necessary to use copper for the coils themselves, because of its conductivity to the flow of high-frequency current. Another important consideration in the designing of induction heating coils is to determine where the current is more likely to flow in relation to the over-all shape or size of the inductor itself. It is generally conceded that high-frequency current travels on the surface of a coil, and that it follows a path of least impedance, or in other words, flows only on the inside surfaces, forming a continuous path or loop within the coil. Metal parts placed within a coil, therefore, enter an intense field and become heated quickly by induced currents. The same part placed on the outside of the coil would heat very slowly, and probably not at all if induced loops were not transferred to the surface of the piece being treated. This phenomenon is important and should be analyzed with each coil, especially those of varied shapes, or of built-up construction.

Good Support Needed

Since high-frequency current travels on the inside surface of a coil, it is possible to provide supports, braces and suitable mountings to their outside surfaces without affecting their efficiency, or the path of the current. A variety of such supports are illustrated in Fig. 5. The example at *A* shows a single-turn coil with three formed supports, brazed to the outside surface of the coil and attached to a transite baseplate. It is obvious that supports of this type provide a rigid means of mounting a coil, which would otherwise be somewhat flimsy. Brass or copper should be used always for these braces, even for the screws used to hold them to the baseplate. At no time should any small portion of the support extend within the coil, as it would then alter the course of the high-frequency current. Small stand-off porcelain insulators, such as at *B*, can also be used as coil mounts, as well as the type shown at *C*, which could be lava, or a section of plastic rod. These supports are small brass lugs, as shown at *D*, a supply of which form a valuable asset to the coil maker. Other supports can be devised to suit conditions, such as the brass-stud design at *E*, which serves the same purpose.

For multi-turn coils requiring bracing, a series of supports can be applied as illustrated at *F*, as long as they are kept on the outside and not connected to any common metal surface which might result in a short circuit. With solid coils, such as that shown at *G*, supporting feet can be connected directly to the coil body without affecting the electrical value

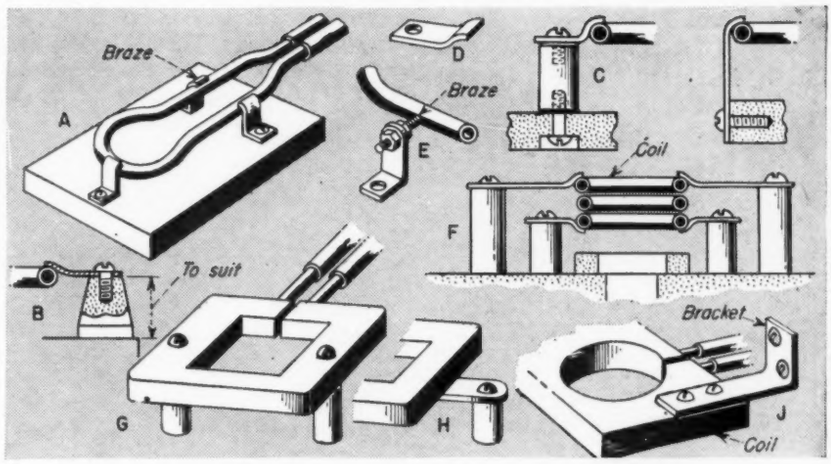


Fig. 5—Coil supports may be designed in great variety provided that they do not extend into the center of the coil

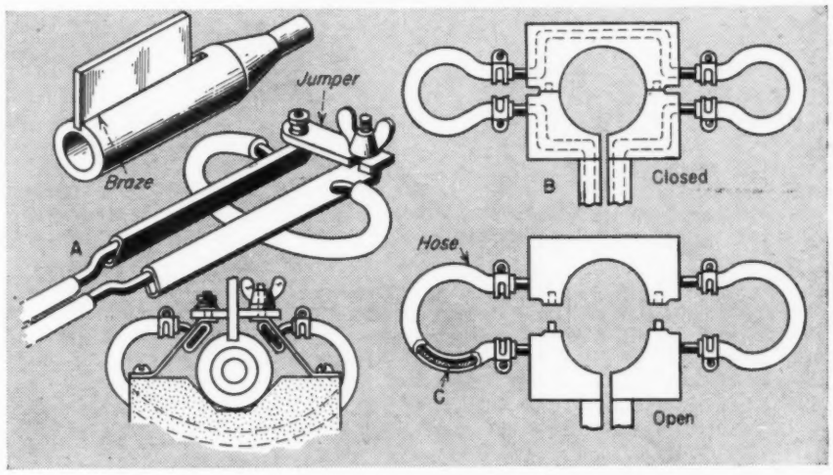


Fig. 6—Two-part coils may facilitate work loading and can be equipped with hose connections to circulate spray water

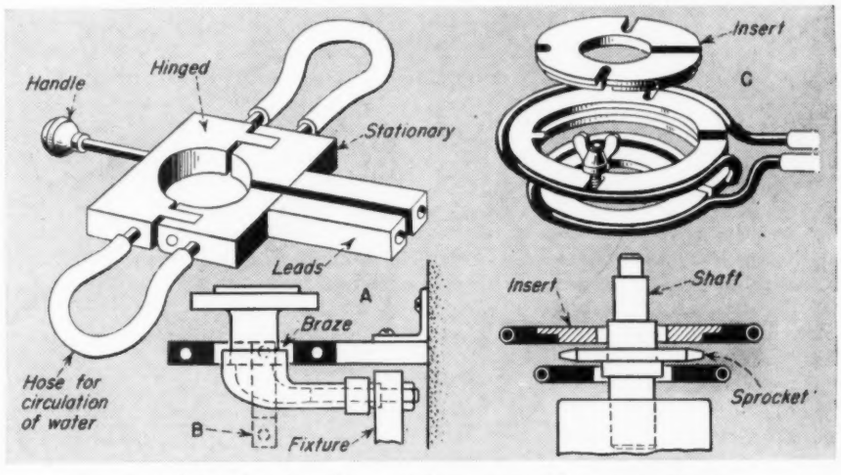


Fig. 7—A hinged coil and one with a removable insert offer two different means of getting the work into the coil

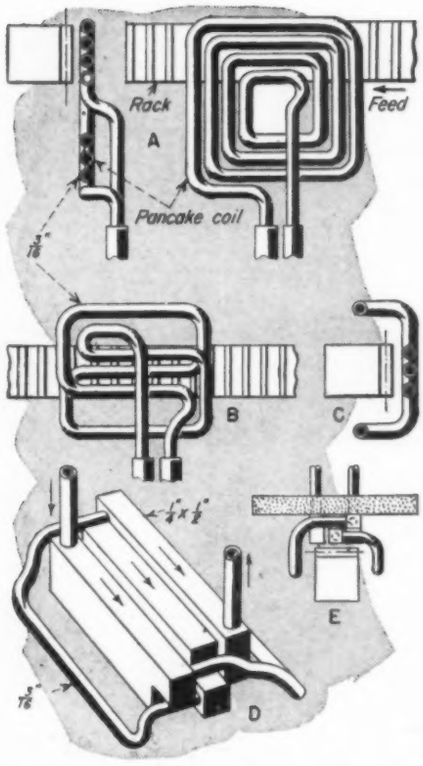


Fig. 8—Pancake coils, while not as efficient as cylindrical coils, have their own field of utility

of the coil, since the effective current only flows on the inner surface of the opening. Another way to support such a coil is shown at *H*, using a small brass strip brazed to the underneath surface of the coil. Brackets at *J* can be used to facilitate mounting.

At *A*, Fig. 6, is a coil assembly used for brazing a flat steel plate to a keyed shaft, which utilizes a hinged jumper, its purpose being to facilitate loading and unloading of the work. The continuity of the flow of cooling water in the coil is by means of a section of rubber hose. The two-piece coil, at *B*, also uses rubber hose connections to insure a continuous flow of cooling water. Split coils of this type are often needed to permit loading of the part requiring heating. The coil must be provided with a positive means of clamping to insure a correct electrical contact when closed. Hinged eyebolts or a cam lock are most usually used for this purpose. Small guide pins or dowels are also advisable to offer proper alignment of both sections when closed. To avoid possible damage to the generator, as might occur if power were applied to the coil in the open position, it is good practice to connect an internal lead within the hose, as shown at *C*. This lead can be a section of braided copper, which of course would be electrically inactive when the coil is firmly closed.

Hinged-type coils are sometimes needed to permit loading of workpieces, such as the steel valve assembly requiring brazing, shown at *A*, Fig. 7. The coil design is illustrated above, and follows normal procedures. The hinged fit should be made tight to insure a good electrical contact. At *B*, is shown the hinged portion of the coil swung down for loading. The coil at *C*, is made with an insert and is used for brazing a sprocket to a shaft, as shown below, which requires the generation of heat from both sides of the sprocket. The insert is required to permit loading of the assembly into the coil; after which it is placed into the upper ring and clamped by wing nuts, and small hinged eyebolts.

Pancake Coils

Heating of flat surfaces progressively such as the teeth of a rack requires the use of a so-called pancake coil, of which several examples are shown in Fig. 8. Pancake coils are not as efficient, from a standpoint of eddy-current transfer, as would be a cylindrical coil surrounding a shaft. Therefore, a higher power source is usually required. Pancake coils, when centralized over a flat steel surface usually result in an unheated spot, directly in the center, often called a "black spot." By making a coil sufficiently large and off-setting it in relation to the rack, as shown at *A*, a rather uniform pattern may be obtained. The coil at *B*, however, is sometimes preferable. It is primarily a small pancake coil with reverse turns, the end loops being turned down as seen at *C* in cross-section, to provide a more positive field to the works surface. The same principle is incorporated in the coil at *D*, which is made from copper bus with copper tube loops. This coil is illustrated in section at *E*, showing the theoretical lines of force set up into the surface of the work. The example shows a variation in coil technique which can be applied readily for other purposes.

With many heating applications, the correct type of coil may be arrived at only after several designs have been tried. In the example at *A*, Fig. 9, for example, which requires the hardening of three lugs cut integral on a forged steel ring, which has been silver-alloy brazed to a long steel tube, the main requirement is to heat the lugs without affecting the brazed joint. Using a two-turn cylindrical coil, as shown at *B*, mounted within a spray quench ring, the lugs heated rapidly, since they projected as small areas from which heat radiation was negligible. However, some of the intermediate areas between lugs became heated, resulting in the use of a small loop coil, as at *C*. This type of coil resulted in currents being circulated only around the lugs, so that the coil illustrated at *D* was applied. With this coil, the lugs were brought up to temperature faster than with the cylindrical coil, and utilized the same spray quench ring. For a more permanent, durable coil, the design shown at *E*, was finally adopted. This coil is made from a flat copper plate, sawed segmentally for electrical distribution, drilled for connection of leads and the three loop coils, as well as for the continuous flow of cooling water. The coil sections are held together by a non-metallic backing. In application, the upper surface is also covered to carry off the water from the quench, as well as to provide a mount for the disk over which the work assembly is aligned and centralized. This type of coil sets up inductance only where wanted, as the copper plate acts only as a means of support with no inductance losses.

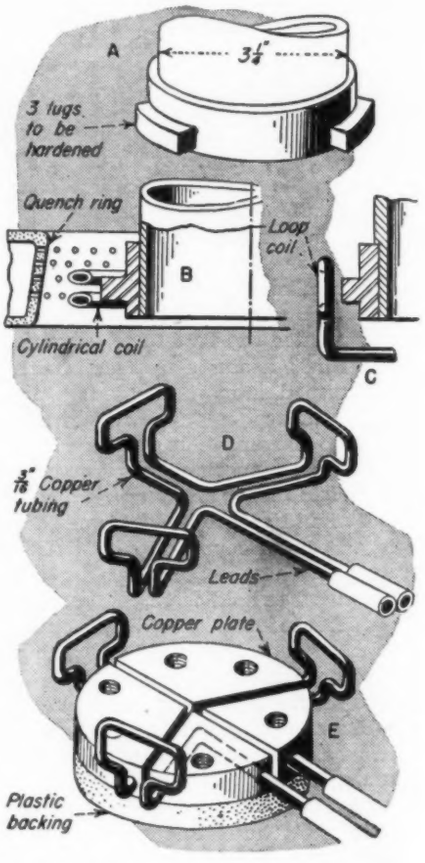
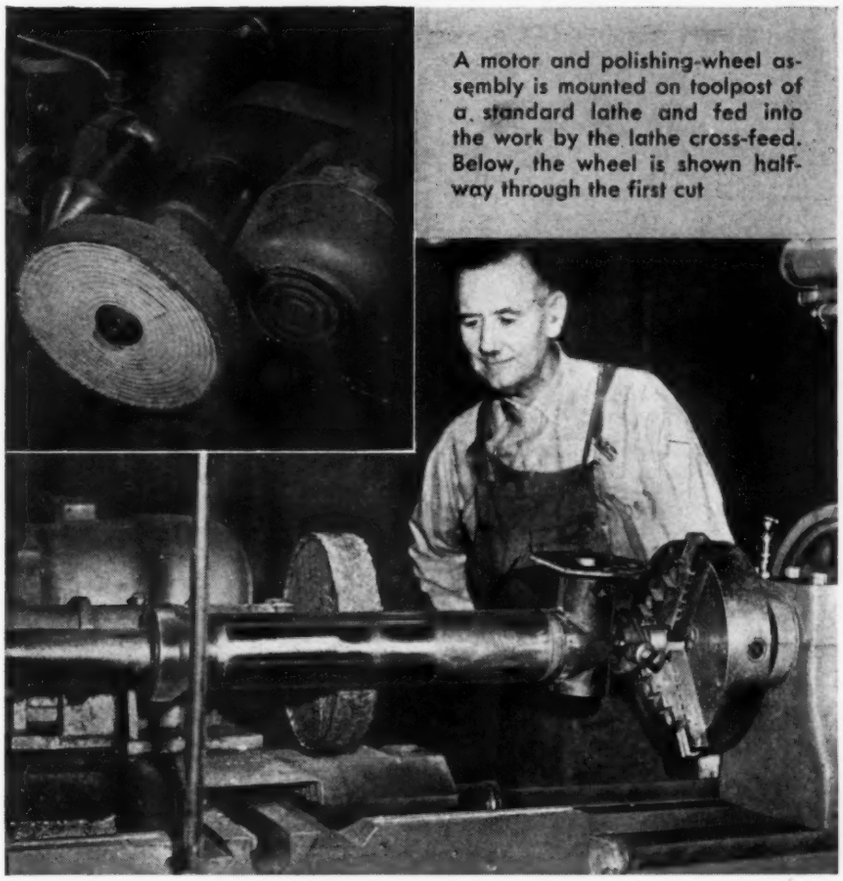


Fig. 9—Four different solutions demonstrate the evolution of coil design for hardening lugs on a steel ring

Pre-polishing Cuts Plating Time 40%

BY G. R. MAKEPEACE
CHIEF CHEMIST
MENASCO MANUFACTURING COMPANY

Main landing gear piston on P-38 processed two hours faster when smooth finishing replaces rough grinding before chromium-plating



A motor and polishing-wheel assembly is mounted on toolpost of a standard lathe and fed into the work by the lathe cross-feed. Below, the wheel is shown halfway through the first cut

BY PRECISION polishing, then chromium-plating to size, we were able to save approximately two hours each in the finishing time of P-38 main landing-gear pistons. Pistons were formerly plated oversize, then ground to size. In addition to the saving in elapsed processing time, economies result from decreased consumption of plating chemicals and electrical energy, from substitution of polishing for a precision-grinding operation, and from elimination of causes for rejection of parts.

Potential savings by chromium-plating large pistons to size were apparent, but the necessity for accurate finishing before plating to a very smooth surface created a major obstacle. Ordinary buffing and polishing machines were inadequate. The difficulty was overcome by adapting a standard engine lathe, mounting a 3-hp. motor and spindle assembly on the toolpost.

The polishing wheel is mounted on the spindle and driven by the motor through variable-speed sheaves. The assembly is traversed with the power screw and fed to the work with the cross-feed. Setting the cross-feed at the end of each traverse is the only hand operation, hence uniform and precisely controlled stock removal is possible. The piston to be polished is mounted in the lathe on a chucked center and rotated at 200 rpm. For rough polishing, a 14-high-count bleached-muslin buffing wheel with ¼-spiral sewing is sized with Ad-Lea-Sive, coated with Lea Compound L, and rotated at 1450 rpm. against the work. The traverse is set at 1 fpm., and the cross-feed adjusted to cut vigorously. Heavy cutting pressures are avoided, however, as they cause burning of the work and excessive wear of the cutting surface of the wheel. Two traverses, the second at lighter cutting pressure than the first, usually suffice to remove all grinding marks. A finish-polishing operation then is performed, using another wheel coated with Lea Compound S and rotated at 1900 rpm. Except for the change in compound and wheel speed, the procedure is identical to that for rough polishing.

This method of finishing is capable of polishing a part uniformly from the rough-ground state to a high finish suitable for chromium plating to size in about 8 min. Approximately 0.00025 in. of stock is removed, or a total of 0.0005 in. from piston diameter. After chromium-plating to size, a final polish is given the piston, using the setup for finish-polishing before plating.

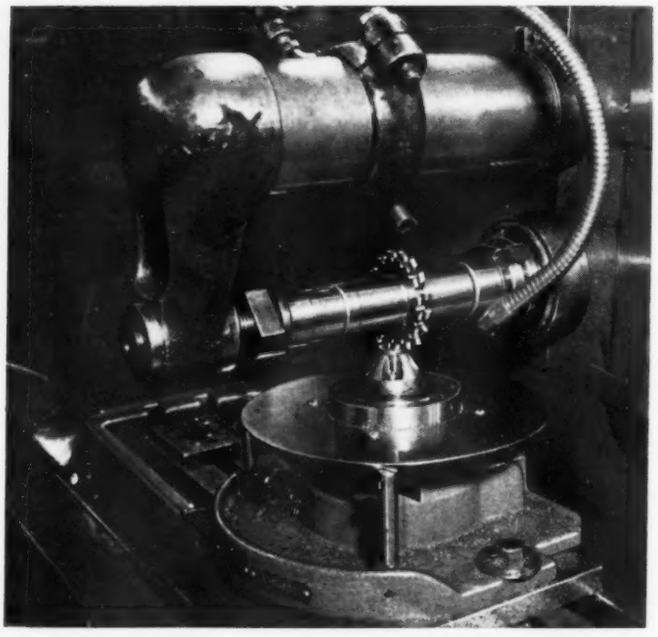
An accompanying table gives step-by-step comparison of operation times, by the two finishing methods.

Parts produced by the new method are of consistently smoother finish than those formerly obtained, and rejection caused by cutting through areas of the plating in final grinding to size have been eliminated.

OPERATION	PRESENT METHOD	FORMER METHOD
Grind before plating	3 min.	5 min.
Polish (total)	8 min.	.....
Chromium-plate	3 hr.	5 hr.
Grind to size	.....	5 min.
Final polish	4 min.	2 min. (av.)
TOTAL	3 1/4 hr.	5 1/5 hr.

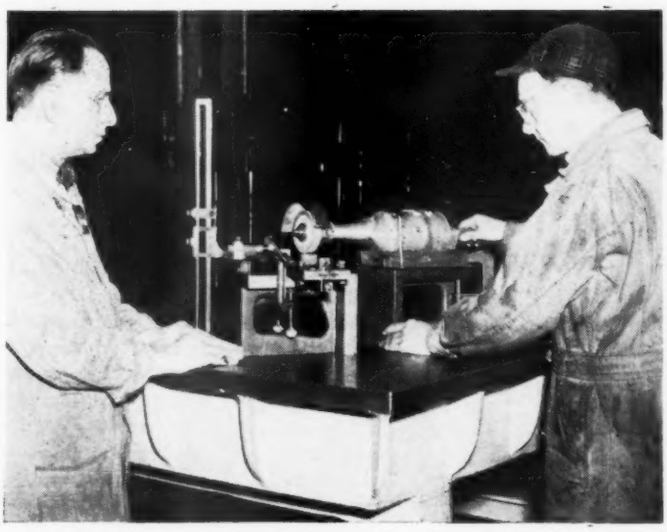
Flanges on sheet-metal parts may be rapidly trimmed to height without scribing or other hand work. A short column supports a bracket carrying a "Lectro-shear" with a special head extending over a table. One cutter blade is motor-driven and works in conjunction with another blade located inside the flange to be trimmed. A scale on the column indicates height, which is set by the second blade. *Pensacola Naval Air Station.*

Blanks were distorted, heavy burrs formed and added machine time truing required when teeth of double-ratchet drive couplings were coin-swaged. Production time was halved when the job was transferred to small millers. As climb milling was used, all burrs were on the outer diameter and could be easily removed by centerless grinding. *Scintilla Magneto Division, Bendix Aviation Corporation.*

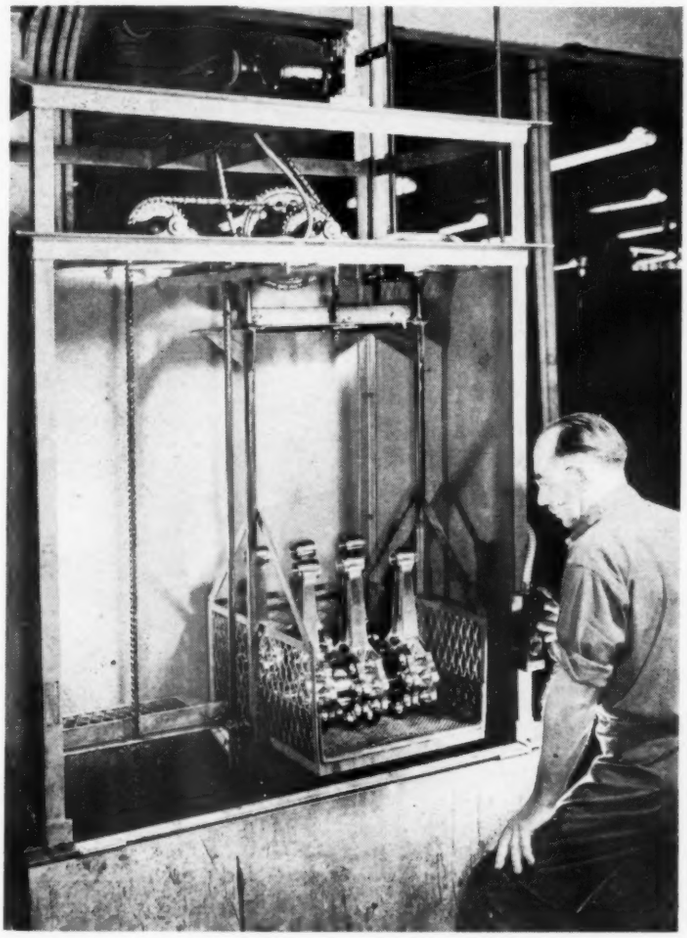


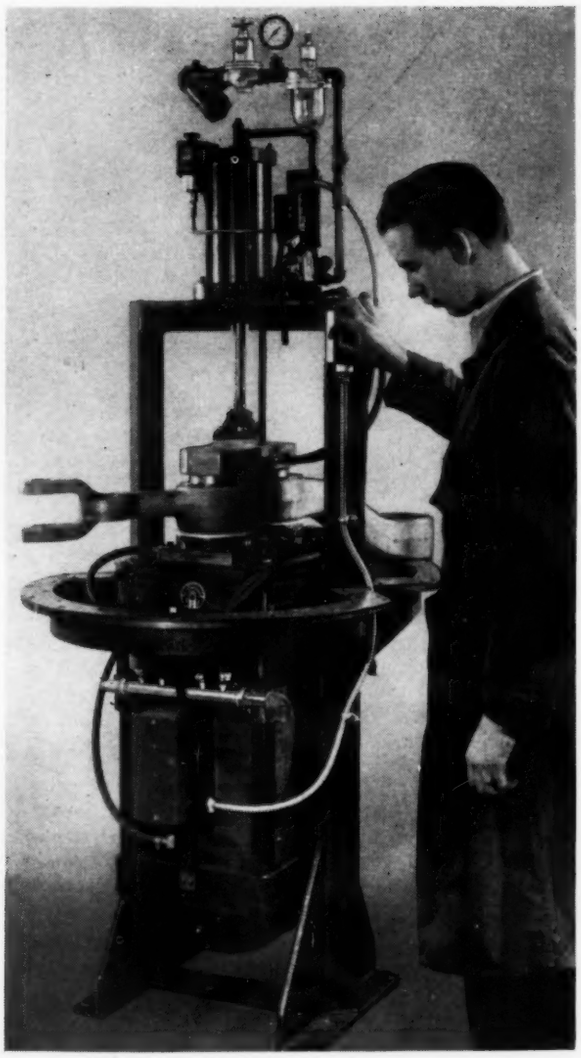
Outer races for ball bearings must be passed through a centerless grinder a number of times to make certain they will hold required tolerances. Segregation of races ground in each pass is accomplished easily with this rotary 4-section hopper at the work station. Races removed from one compartment for a grinding cycle are returned to an adjacent compartment automatically by the steel track leading from the machine discharge. *International Harvester Company.*

SHOTS



Replacing hand-filing by portable grinding resulted in faster and more accurate finishing of small and medium-sized jigs. Both jig and portable grinder are clamped on suitable angle plates and accurately positioned on a surface plate, as shown above. *Douglas Aircraft Company, Inc.*





Heating time of suspension-arm bores for shrink-fitting of serrated spindles has been reduced to a seventeenth of the previous time by a 60-cycle induction heater, made of standard resistance-welder components. A 100-kva. welder transformer, an air cylinder and stock-control units are the main requirements of the assembly. One section of the heating coil can be raised and lowered by the air cylinder to allow insertion and removal of the work. Cold-treating of male components for shrink fitting is eliminated by this method. *Progressive Welder Company.*

←**Positive control** of the rate at which precision parts go through the degreasing bath is provided by an elevating mechanism driven by an electric motor. Parts are placed in a basket, and the operator pushes a button lowering it into the degreasing tank at a predetermined rate. A basket on the other end of the same chain can be loaded while parts in the first basket are being degreased. *Chevrolet Motor Division, General Motors Corporation.*

Silver Alloys Braze Auto Parts

BY
ADOLPH
BREGMAN
Consulting
Engineer

High-strength joints brazed to meet wartime mobile-equipment requirements suggest increased automotive use of silver alloys

SILVER-ALLOY brazing first met the high-production requirements of the automotive industry in the last years of the war. Developments in the process, which preceded and made possible this growing application to automotive-equipment assembly, were:

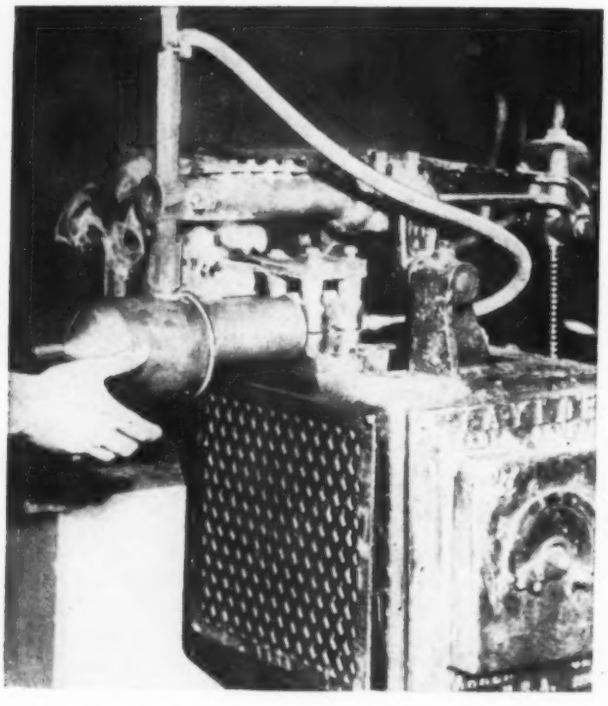
1. Low-melting-point, silver brazing alloys.
2. Improved application methods, such as preplacement of standard forms and shapes of alloy in the joints.
3. Better heating methods and equipment, ranging from oxyacetylene torches to controlled-atmosphere and induction heating.

Before the war, silver-alloy brazing was being applied in gradually increasing quantity on engines and automotive equipment. Oil floats, nameplates and trim, headlight connections, oil coolers, gear shift levers, steering-wheel spiders, contact joints, window frames, radiator grilles, pneumatic systems, temperature controls, and accessory radio equipment and antenna were typical applications.

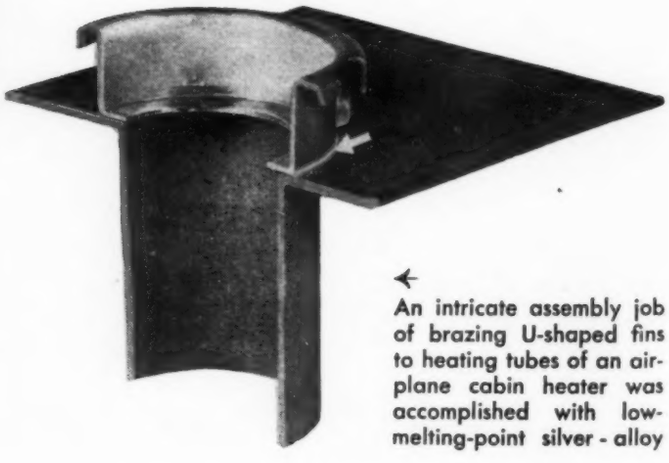
In the production of tanks, jeeps and trucks the increased facility of silver-alloy brazing made possible a variety of new automotive applications. Many of these, which are outlined in tabular form, will be readily applied in current automotive production and assembly lines.

↑ Body, tube and bracket of this steel shut-off valve for auto heaters are joined in one operation by silver-alloy brazing. Parts are assembled with two preplaced 1/32-in. silver-alloy rings in a furnace and are held at 1900 F for 8 to 9 min.

← Thin-wall steel tubing and steel components were assembled and brazed with silver-alloy rings in one operation in furnaces. This automotive unit successfully met final 600- to 800-lb. oil-pressure tests



The braze in this thin shell assembly is accomplished rapidly as a treadle forces the electrode down pneumatically to turn on the brazing current ←

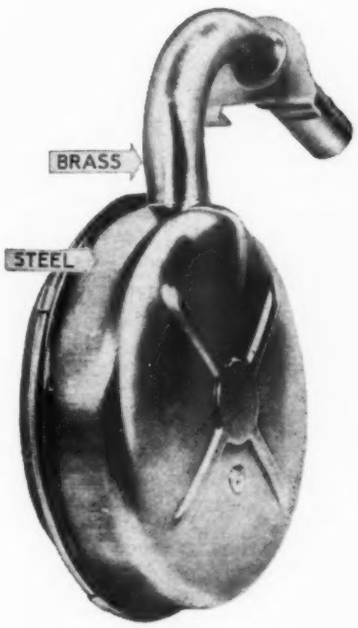


← An intricate assembly job of brazing U-shaped fins to heating tubes of an airplane cabin heater was accomplished with low-melting-point silver-alloy

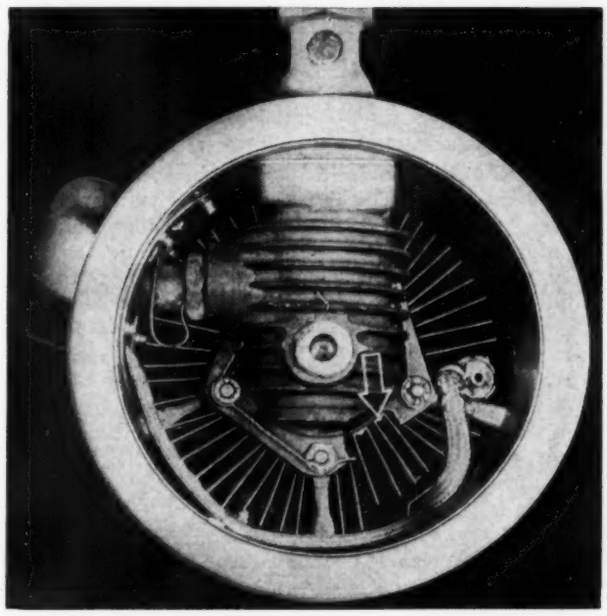
SILVER-ALLOY BRAZING APPLICATIONS ON MOBILE WAR EQUIPMENT

PART NAME	METALS JOINED	TYPE OF JOINT	ALLOY USED	APPLICATION
Trucks				
Body Connections	Steel	Lap	Easy-Flo	Torch
Steering Knuckles	Steel	Lap	Easy-Flo	Furnace
Cooling Unit	Copper and Brass to steel	Lap	Easy-Flo, 1/16" wire Sil-Fos, 0.050 x 1/8 strip	Torch
Brakes	Steel to brass	Lap	Easy-Flo	Torch and Furnace
Transmission Parts	Steel	Lap	Easy-Flo	Torch and Furnace
Segregator Floats	Brass to brass Copper to copper	Butt with backing strip	Easy-Flo, 1/16" wire	Torch
Diesel Engines				
Fuel and Oil Manifolds	Steel	Lap	DE, Easy-Flo	Torch
Fuel Filters	Brass to steel Steel to steel	Fillet and Lap	Easy-Flo, 1/16" wire	Stationary torch; part revolved and steel caps brazed to ends of perforated brass cylinders
Evaporator Cooling unit	Steel	Butt	Easy-Flo, 1/16" wire	Torch
Injectors	Steel	Lap	Easy-Flo, 3/64" wire	Torch
Oil lines	Copper	Lap	Easy-Flo	Torch
Gasoline Engines				
Contact points	Silver and Copper to steel	Butt	Easy-Flo	Resistance unit; torch
Oil inlet connections	Steel	Tubular	Easy-Flo	Furnace; torch
Fuel lines	Brass to steel Copper to brass	Lap	Easy-Flo	Torch
Tanks				
Radiator assemblies	Brass to copper	Lap and Butt	Sil-Fos. 1/16"	Torch
Clutch disks	Steel	Lap	Easy-Flo, 1/16" wire	Torch and electric resistance
Tractors				
Fuel lines and manifold assemblies	Steel to steel Brass to steel Brass to cast iron	Lap	Easy-Flo	Torch and electric resistance

Easy-Flo is a proprietary alloy containing 50% silver, 15.5% copper, 16.5% zinc and 18% cadmium. Melting point is 1160 F and flow point 1175 F
Sil-Fos is a proprietary alloy containing 15% silver, 80% copper, and 5% phosphorus. Melting point is 1190F and flow point 1300 F.

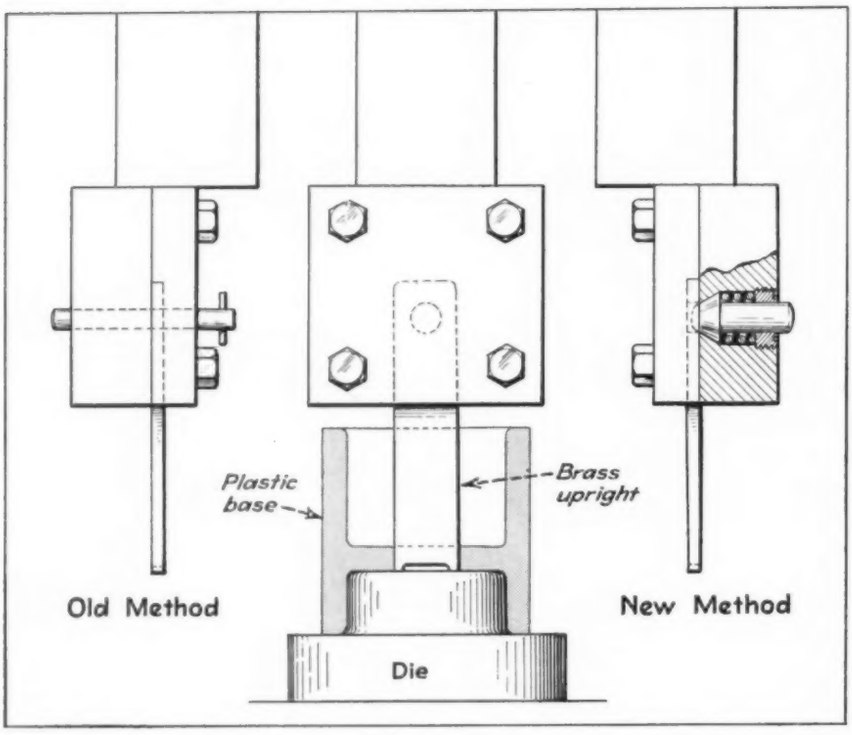


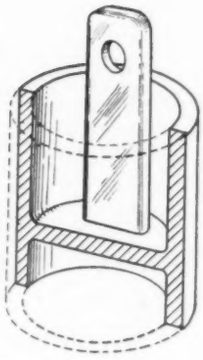
← A 3¾-in. yellow-brass tube and a stamped circular steel body only 0.015 in. thick comprise this auto engine float. The brazed joint must withstand constant vibration at temperatures up to 300 F



→ Silver-alloy brazing increased production on this tank filler-cap seal and anti-splash pipe from 4 to 16 an hour and eliminated leaks

Tapered Pin Provides Rapid Staking





A brass upright was staked in a plastic base faster (right) by putting a spring pin in the holder

STAKING a brass upright into a slotted plastic base can be simplified and speeded up by using a spring-actuated tapered pin in the punch instead of a conventional locating pin.

The plastic base is molded with a slot offset from the center line. The upper end of the die block is machined to a good sliding fit for the lower end of the plastic base.

A rectangular plate, fastened to the main portion of the punch, has a slot machined to receive the brass upright and another plate bolted to the back of this plate. A hole of the same diameter as the hole in the upright is drilled through the two plates. To use this punch and die the operator places one of the bases on the die, slips an upwright into the punch slot and puts a locating pin through the hole in the punch. The upright is brought down through the base slot and against the die to be staked in place. Here the locating pin serves only as a holding medium and considerable time is lost placing and removing it.

A tapered pin, held in the back plate of the punch by a thread nut and spring, readily locates and holds the upright as it is slid into the slot. After the upright has been staked into position the operator can slide the assembled unit out by pulling the parts down, this action pushing the pin out of the upright. In addition to a production increase there is no danger of lost time from lost pins.

Jet Propulsion

ROCKET POWER is a dizzy subject anyway, but some speeds predicted by G. Edward Pendray leave his audiences dizzier than ever. Mr. Pendray is a rocket pioneer, being one of the founders of the American Rocket Society and at present its secretary. He pointed out that jet engines for aircraft begin to be effective only at the point where propeller-driven aircraft must leave off; that is, at speeds above 450 m.p.h., at altitudes greater than six to eight miles, and at power output per engine from 3,000 hp. up. It has been calculated, according to Mr. Pendray, that jet engines for aircraft can probably be built with thrusts as high as 15,000 lb. per engine, and since at speeds of the order are 370 m.p.h., 1 lb. of thrust is equivalent to 1 hp., this means that single engines can possibly be built which will deliver, under suitable operating conditions, horsepower as high as 15,000 or more.

"As to jet engine speeds," said Mr. Pendray, "here again we do not know practical limits, but it seems not unlikely that velocities up to 1,500 or 2,000 miles an hour will be possible as far as the engine is concerned. Engines so far developed will be capable of much higher speeds than present aircraft can fly.

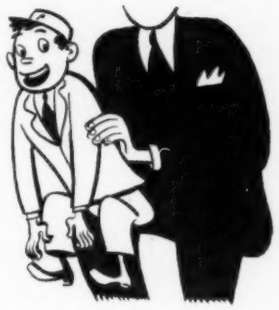
"Speeds of even 1,500 or 2,000 miles an hour do not by any means represent the maximum that can be reached with the aid of jet propulsion motors and engines. When we turn to true rocket motors, that is, to those in which the oxidizer as well as the fuel is supplied as part of the propeller, velocities measured in miles per second are readily obtainable.

"The best liquid-fuel rocket motors at present developed are jet velocities of between 6,000 and 7,000 ft. per sec. Since it is quite possible to build rockets which will reach the speed of the jet of their own motors, this means that we can think in terms of velocities during some portion of the projectory of such a rocket which will exceed a mile a second or 3,600 miles an hour."

This was pretty fast talk for Mr. Pendray, but no one can laugh at him since that is exactly what everyone did when he pioneered rockets at a time when rocket power was definitely in the Buck Rogers class.

ROUND TABLE

Mouthpiece or Manager?



"The Big Boss told me to tell you it was O.K. for me to have next Thursday off," said Tom Ainsley. At the look on Ed's face, Tom beat a hasty retreat, almost bowling Al over on the way out.

"What gives, Thundercloud? You look like you'd swallowed a volcano and it's about to erupt," said Al.

"That tinhorn Tom! Just because he married the Boss' sister, he's always wangling his way around me. I'd fire him in a minute, and he darn-well knows it, if it wasn't for his family tieup!" Ed was purple and gasping for air.

"Be reasonable, Ed. That's one of those things that nobody can do anything about. Relax and roll with it."

"Relax nothing, Al! Either I'm boss in my own department or I'm through. Tom ain't gonna have no special rights or privileges as long as he's working for me—and neither is anybody else."

"Why, nuts, Ed, you can give Tom the day off on Thursday just as well as not. The toolroom isn't as busy as all that."

"As you know damwell, Al, that ain't the point. If Tom Ainsley wanted next Thursday off, why didn't he come and ask me like a man, instead of going over my head?"

"Where he should have gone is to the personnel manager, Ed, under the new setup. Your job is shop operation, not personnel problems."

"Ah, don't start that stuff, Al! I can still run my own department, regardless of these service outfits with their specialists that were still wearing diapers when I started here."

"The specialists, as you call 'em, Ed, are here to help, not get in your way. Their job is to fill the blank spots you don't get around to or aren't up on. They don't bust in unless you need 'em and ask for 'em."

"Except that the personnel manager has to O.K. every man before I hire him, the safety director looks over everything to see if it's safe, the planning department checks methods, the master mechanic checks machine installations, and so on. Outside of that, I run my own show."

"That's just to give those boys something to keep their hands in, Ed."

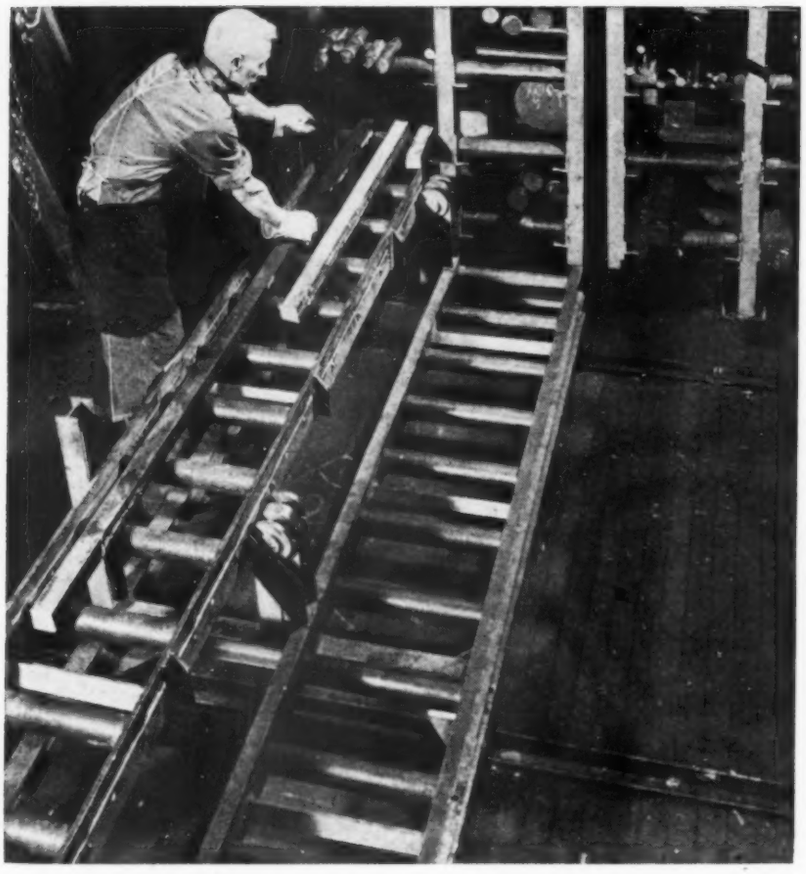
"Their feet in, you mean, Al. It ain't like the old days, when a foreman was the boss of his department. Nowadays, he's just the fall guy for a bunch of advisers. I'd like to be a real manager—or nothing."

"Well, Ed, you're still darn close to that. You're not a mouthpiece like the foremen at the pump plant across the street. They're just errand boys and spies for the owner, and some of the others here in town are just gang leaders. They make less than some of the men who work for 'em—they're labor pushers, that's all."

"Compared with those guys, Al, I admit our jobs are what they ought to be. We have rights and authority; we're really managers compared with them, but I'd still like to go back to the old system when every foreman was complete boss and ran his department like an outside shop. He bid on work from the office against outside shops, and he stood or fell on his own abilities, without help."

***WHEN IS A FOREMAN** not a foreman? Should he have complete rights in his department? How about so-called "service" departments and the tendency in some plants to make the foreman just a "pusher" or gang leader for labor? What should a foreman's job be? Your opinions and ideas will be appreciated by others. Send them in; those published will be paid for.*

ROLL OUT THE BAR STOCK



BY J. W. INGRAHAM
SUPERINTENDENT, TOOL DIVISION
MANSFIELD WORKS, WESTINGHOUSE
ELECTRIC CORPORATION

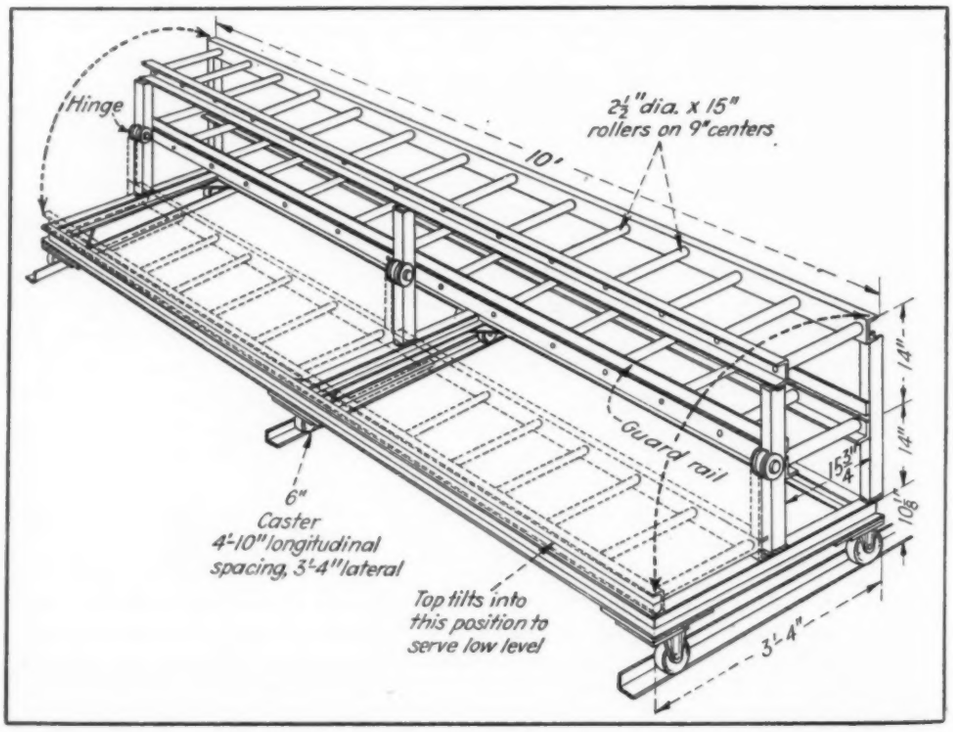
Conveyor carriage and racks end problems in handling tool-steel bar stock in toolroom stores

STORAGE of bar stock in the toolroom is always a problem, because a wide variety of sizes in various grades of tool steel must be stocked accessibly, usually in small quantities for any given size and grade. We have solved this problem by developing special roller-conveyor bar-stock storage bins with three levels of conveyor lines. Four bins are spaced in the stockroom so they can be served by a special three-level table. Mounted on casters, this table can be moved easily to align its roller-conveyor surfaces with those in bins.

The design of the table is unusual in that only two sections of roller conveyor serve the three levels of conveyor lines in the stock bins. In these bins, the lower conveyor line is mounted so the top surface of the rollers is 12¾ in. above the floor and the three levels of conveyor lines in the bins are spaced vertically on

Frame of the conveyor table is a welded assembly of 3-in. steel I-beams and channels. The hinged section is carried on 2-in. pins at three points, as shown. Each of the conveyor sections is stiffened with four 2 × 2 × ¼-in. angle sections welded in position between the side frames

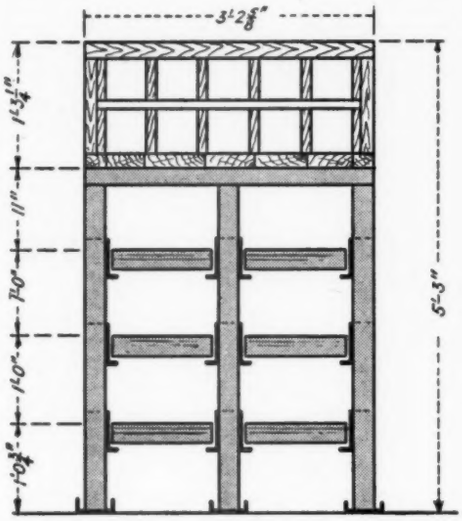
With a roller-conveyor table, it is an easy matter to move heavy bars of tool steel into and out of the roller-conveyor toolroom stock bins. This table is 10 ft. long, 40 in. wide and is supported on 6-in. casters which run in three channel tracks set on 58-in. centers in the floor of the stock crib. One section of the conveyor on this table is hinged to serve either the upper or the lower level of the conveyor lines in the stock bins



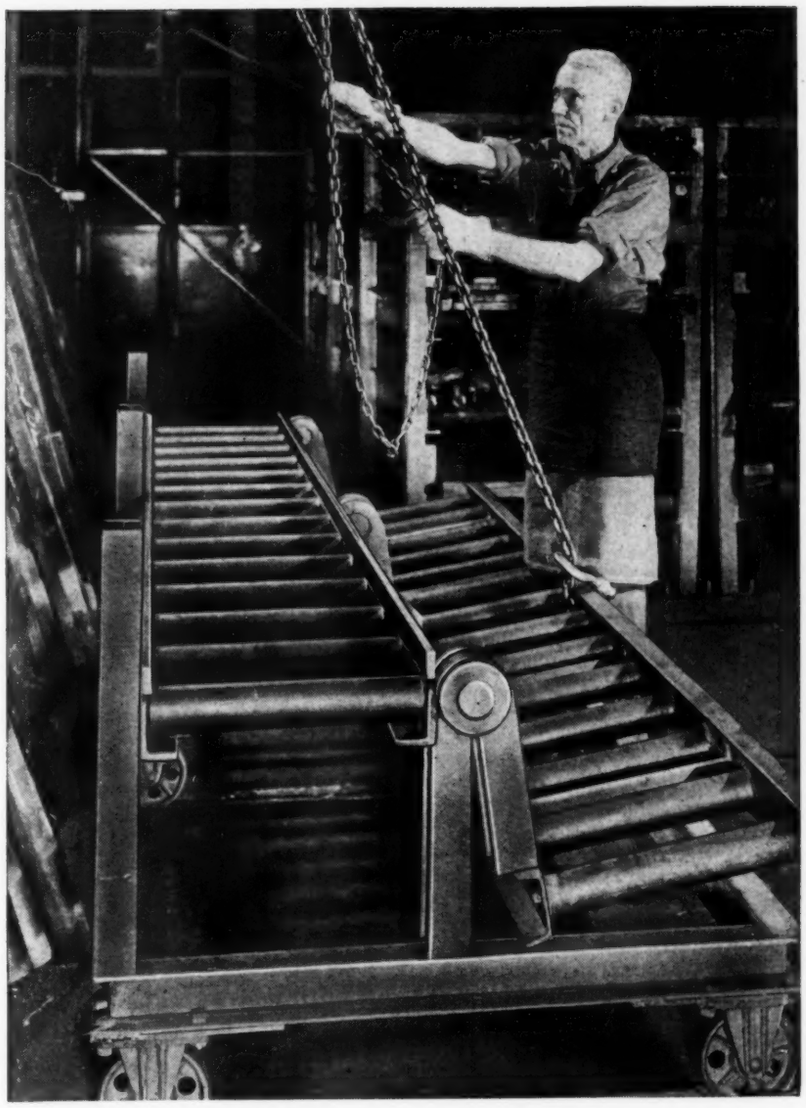
12-in. centers. The fixed conveyor unit on the movable table is mounted so the tops of the rollers in this section are 24¾ in. above the floor level. Thus, this sections aligns with the center conveyor section in each of the bins.

A principal advantage of this table design is that the stock-crib attendant has complete freedom of action when moving bar stock on any one of the three levels of the table. At no time is it necessary for him to work at a conveyor level when that level is covered by another conveyor line.

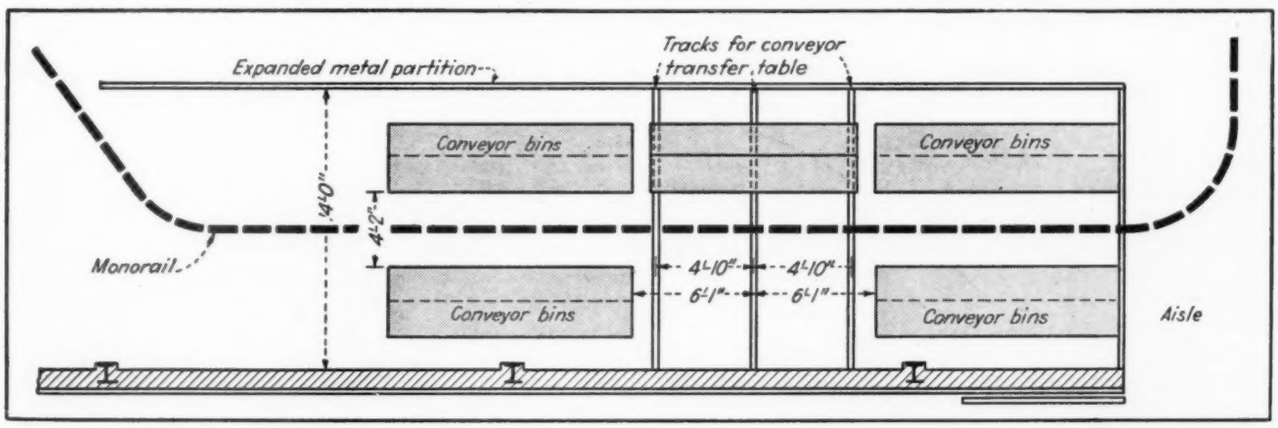
These bins are now placed side by side, with two bins at each end of the movable table. This arrangement has been necessary because space in the stockroom has been at a premium throughout the war.



Each of the roller-conveyor storage bins has three pairs of roller conveyor sections, with the rollers spaced on 12-in. vertical center lines. Above each bin is a wood rack for storing small rounds and other shapes easily moved by hand

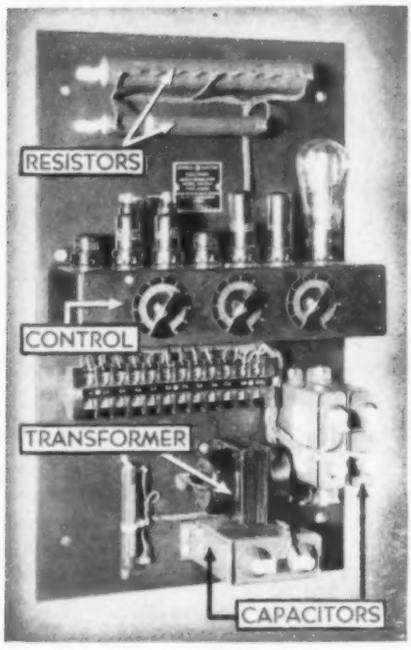


It is an easy matter for the hinged section of the roller-conveyor table to be moved from the lower to the upper position with a chain hoist supported from a monorail track. This arrangement permits an open working surface, no matter which level of the table is being used



Ideal postwar arrangement of the four conveyor storage bins and the conveyor transfer table is shown here. The bins are spaced on either side of a 50-in. wide aisle, along which runs a monorail track from which a hoist is suspended. This permits moving bar stock from the transfer table to the toolroom as needed. Providing space around each of the bins simplifies the work of the attendant

What Electronic Tubes Can Do



ELECTRONIC EQUIPMENT like this motor control offers four uses: to rectify, to turn current on and off, to amplify, and to change frequency

THE ELECTRONIC TUBE has two main functions. First, it acts as a one-way check valve. Since only the cathode can emit electrons, the tube permits current to flow through it in one direction but not in the other, in much the same manner that a check valve controls the flow of water through a pipe. Second, it may act as a throttle valve. As the flow of electrons from cathode to anode can be controlled by various means, the tube can be made to control the amount of current which flows through it just as a throttle valve controls the amount of water flowing through a pipe.

Electronic tubes, performing these two basic functions, are combined with familiar electric devices, such as resistors, controls, potentiometers, rheostats, capacitors, transformers, and so on. The resulting complete electronic equipment, like the motor control, offer four fundamental uses:

1. To rectify, that is to change a.c. to d.c.
2. To turn current on and off.
3. To amplify, that is, using a feeble electrical signal to govern the application of a large amount of power.
4. To act as a frequency changer, changing electrical current from one a.c. frequency to another or even changing d.c. to a.c.

Here are a few typical examples:

To rectify: In electric transit systems, a.c. is changed to d.c. to power modern street cars and electric coaches. Deep beneath the surface of the earth, portable electronic rectifiers supply dependable current for mining operations. Group installations of large ignition rectifiers provide d.c. required for huge electrochemical processes.

To turn current on and off is a second fundamental use. This use in resistance welding, where the precise control possible with electronic equipment is the key to high-speed, high-quality production.

In molding plastics, electronics has added to quality control by accurately timing the operations of molding presses. A typical application of the electronic tube's ability to turn current on and off is its use in devices for counting, selecting and sorting.

To amplify is a third use. On huge multi-color printing presses, the minute change in the light from a phototube from a faint, thin line printed on the paper is amplified to position the speeding rolls of the press.

In the world's largest theatre, the slightest movement of a tiny lever at the lighting director's finger-tips is amplified to regulate thousands of watts of light, from complete blackout to full brilliance.

In inspecting metal strip to be used for tin cans, the light passing through minute pinhole flaws reacts on a phototube and is amplified to operate marking and rejecting devices that remove imperfect sections.

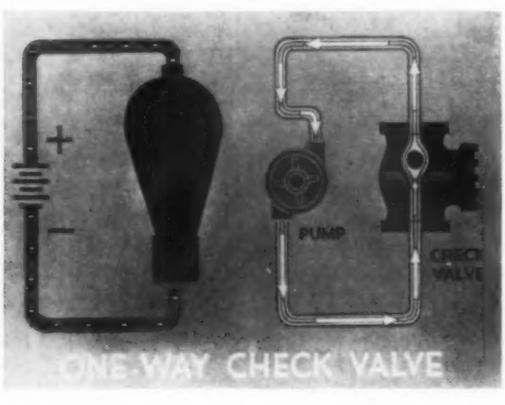
Finally, as a frequency changer, electronics has opened an entirely new field in the high-frequency heating of materials.

Radio depends on electronic tubes for the high frequencies used in broadcasting operations. Changes are also possible in low frequencies. A 20,000-kilowatt frequency converter "ties in" a 25-cycle line with a 60-cycle line. It permits flow of power either way.

Electronic equipments bring a number of advantages to the above and to countless other applications: Instantaneous response, quiet operation, no moving parts, lack of vibration, and little or no servicing.

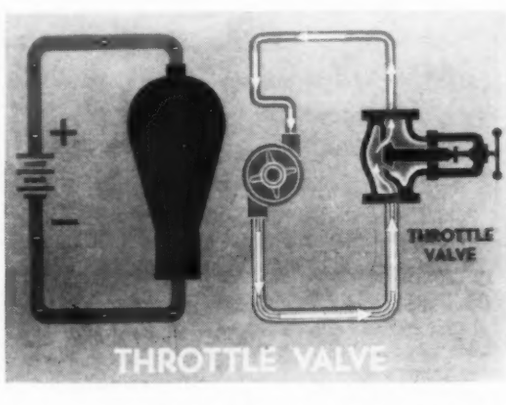
With these and other electronic tubes we greatly widen the field and increase the services of electricity.

Based on a sound slidefilm in the General Electric industrial electronics course.



← The tube allows the current to flow one way but not in the other

→ The flow of electrons from cathode to anode can be controlled



WARS are destructive and do little to settle world problems. There are few who would not agree that the woe and bloodshed that go with them far outweigh any possible gains.

But, as a matter of record, war does accelerate development in engineering and manufacturing techniques. It telescopes into a few years strides that would ordinarily take decades. The reasons are obvious. Cost is not an object; speed may decide between victory and defeat.

World War II was fought by machines and men. It saw the machine reach a new peak of importance which dwarfed its place in any previous conflict. The making of these machines was recognized as a controlling influence in the outcome and was rightly given the same close supervision as the strategic maneuvers at the front.

The metals that went into war machines were called upon to give service unprecedented in engineering design. They had to be light but tough, whether used on land, sea or air; they had to take punishment unparalleled in peacetime service.

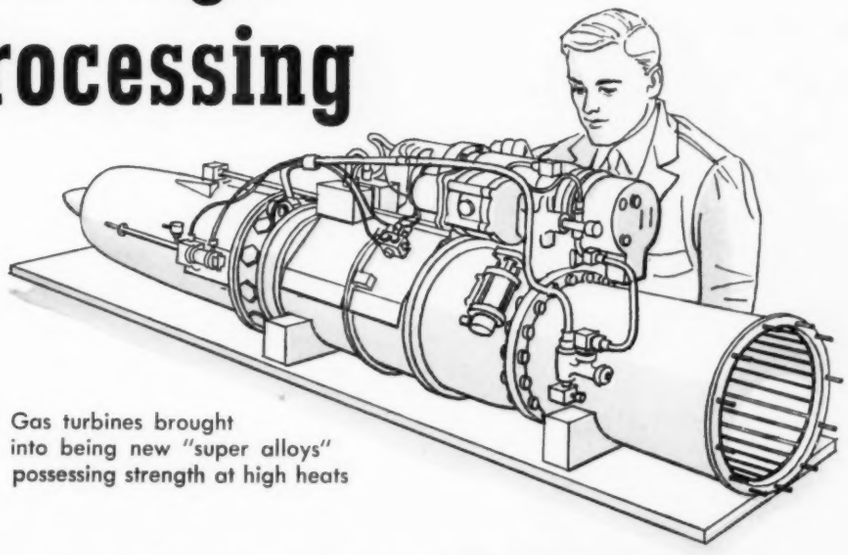
The wartime functions of metal parts necessitated new means of fabrication and novel methods of metallurgical treatment. They called for changes in the metals themselves, first, to compensate for shortages in certain alloying elements and, second, to fit them for better response to processing.

These developments produced outstanding performance; many of them will profoundly influence postwar manufacture. Some of the methods were entirely novel. Others consisted of the application of acquired knowledge that had been previously put to work on a limited scale. The atomic bomb had its roots in the work of the Curies years earlier but it took World War II to release the terrific energy present in radio-active elements. In much the same way manufacturing methods in the early stages were quickly put to work to win the war.

It is the purpose of this section to examine some of these developments, particularly those having to do with metals, heat-treating, welding and metal finishing, and to appraise their meaning to postwar industry. The knowledge that has been gained must be put to constructive use and thus balance in part the vast destruction of the late war.

War Turns a Page in Metal Processing

METALS



Gas turbines brought into being new "super alloys" possessing strength at high heats

FORESIGHTED ENGINEERS and shop men seeking to use war-developed metals in peacetime applications will not find a bewildering array of new alloys available for general engineering purposes. At the outbreak of the war, the United States possessed broad experience and enormous facilities for production of various metals and alloys. The job, then, was to increase over-all production, expand facilities for specialty products, cope with substitute analyses, develop certain special analyses, and of course greatly to expand the aluminum and magnesium industries along with devising many new alloys in these light metals. Thus, the carryover of basically important new alloys for engineering purposes depends upon the metal industry concerned. Some of these, such as copper and zinc, possessed an ample range of engineering materials for the war program.

Other fields, such as steel, aluminum, magnesium and powder metals, contributed new materials that will be evaluated for postwar use, insofar as unsettled conditions and industrial reports will permit.

Four Triple-Alloy Steels

Early in the rearmament program, it became painfully evident that the United States is a "have-not" nation in respect to natural resources of metals needed to make alloy steels. One of the greatest achievements of the steel industry was the successful formulation of the National Emergency, or lean-alloy, steels. These passed through several phases. Final-

A.S.T.M. DESIGNATIONS FOR MAGNESIUM ALLOYS

A.S.T.M. ALLOY	THE DOW CHEM. CO. DOWMETAL	AMERICAN MAG. CORP. AM. ALLOY	NOMINAL COMPOSITION
A8	A	241	Mg—8.5 Al
A10	G	240-59S	Mg—10 Al
A12	B	246	Mg—12 Al
AS100	K	230	Mg—10 Al-1 Si (max.)
AT35	D	65S	Mg—3.5 Al—5 Sn
AZ31	FS	52S	Mg—3 Al-1 Zn
AZ33	X	74S	Mg—3 Al-3 Zn
AZ51	JS	54S	Mg—5 Al-1 Zn
AZ61	J	57S	Mg—6.5 Al-1 Zn
AZ63	H	265	Mg—6 Al-3 Zn
AZ80	O	58S	Mg—8.5 Al-0.5 Zn
AZ90	R	263	Mg—9 Al-0.7 Zn
AZ92	C	260	Mg—9 Al-2 Zn
AZ101	P	88S	Mg—10 Al-1 Zn
M1	M	403-3S	Mg—1.5 Mn

Notes—1. If above compositions are of controlled high purity with low Ni and low Fe impurities, the designations are modified as follows:
ASTM —Add X, thus: AZ61X
Dow —Add -1, thus: J-1
Am. Mag. Corp.—Precede with C, thus: AM-C 57S
2. In all compositions, except M1, manganese is present as a required constituent in amounts from 0.1 to 0.2 percent.

ly, in June, 1945, the NE designations were dropped, but four "triple-alloy" engineering steels were incorporated with the open-hearth and electric-furnace alloy steels listed as standard by the American Iron & Steel Institute. These triple-alloy steels, so-named because they contain nickel, chromium and molybdenum, are the A8600, A8700, A9300 and A9800 series.

As matters stand now, the steel industry is prepared to furnish standard alloy steels that practically blanket the SAE grades, plus the four triple-alloy steels. The future of the new steels is uncertain at this time. Their quality is beyond dispute but commercial aspects will undoubtedly play an important part in their general adoption.

The scrap situation has a bearing upon the reasons why the triple-alloy steels are offered. For years, the percentage of alloying constituents in steel scrap have been rising. This trend will continue, with the prospect that nickel, chromium and molybdenum will be residual alloys in the melt. And since steel cannot be made without using a high percentage of scrap in the charge, time may prove that it will be easier for the steel industry to supply triple-alloy steels against strict requirements for uniformity of hardenability and machinability.

Hardenability bands for the A8600 and A8700 steels have been established by a committee of experts, and bands for the other two series may be available soon.

The status of the triple-alloy steels may change. The A8600 and A8700 series are alike except for slight differences in molybdenum content. So there is a possibility that the A8600 will be dropped. The A9300 series is an alternate for the SAE 3300 carburizing grades, and its use may depend upon consumer acceptance. The A9800 series is actually a new group of steels developed for heavy forgings and apparently destined for important application.

Forecast is the development of a series of triple-alloy steels having shallow, intermediate and deep-hardening characteristics. Under prewar conditions, the SAE 4100 series were "pushed" to the limit of hardening in order to conserve alloy. The SAE 4300 series were too rich in alloy for many purposes and full advantage of their deep hardening characteristics was not always required. The prospect is that a triple-alloy steel intermediate in hardening capacity between the SAE 4100 and SAE 4300 steels will be developed.

Experience was gained with steels incorporating intensifiers such as boron, but many factors concerning them are still unexplained. It is probable, therefore, that the use of such steels will be restricted until laboratories are able to supply more information about their behavior in commercial practice.

From Armor to Plow Shares

Many steel analyses were adapted for military purposes. For example, a 6 percent tungsten tool steel was first used for AP shot, but modifying a triple-alloy steel for truck gears enabled satisfactory projectiles to be made. A manganese-moly analysis used for ore-crushing jaws, was adjusted in carbon content and heat-treatment to serve as armor-piercing projectiles. The latter is now available for applications involving dynamic loads, high tensile and impact strength—a combination of properties desirable in mining equipment.

Over 5000 shops are reported to have learned how to fabricate stainless steels during the war. Progress in the welding of stainless steel tubing developed to the point that cracks at the welds were no longer troublesome. Stainless steels are being rolled in extremely fine sheet and wire gages. There was developd an 18-8 analysis with 1 percent beryllium to give maximum strength and hardness at temperatures up to 1380 F., as required in chemical processing equipment. Another 18-8 variety will be heat-treatable. Other developments are coming in respect to easier forming and cold heading.

New Steels for High Heat

Until recently, the "super alloys" developed for jet engines were secret. Restrictions have been removed and commercial applications are now permissible, such as automobile and airplane engine valves, turbine buckets, jet engines, gas turbines and other uses where strength must be retained at high heat. An insight into the wartime progress made with these alloys is found in this comparison: the best original material gave 100 hr. at 1500 F, while subjected to 14,000 psi.; one of the latest survives 1000 hr. at 1500 F. and 19,000 psi. One of these metals is forgeable and is offered for service under high stresses at temperatures between 1300 and 1450 F. Castings are stronger at operating temperatures above 1500 F., but techniques of making sound castings of required size have yet to be mastered.

Aluminum Broadens Its Field

The outstanding aluminum alloy developed during the war is a heat-treatable material in which the principal hardening constituent is a zinc-manganese phase. Commercial materials in this category are Aluminum Company's 75-S and Reynolds Metal Company's R303. The composition of 75-S is as follows:

COMPOSITION OF 75-S

	Per Cent	
	Minimum	Maximum
Zinc	5.1	6.1
Copper	1.2	2.0
Magnesium	2.1	2.9
Manganese	0.10	0.30
Chromium	0.15	0.40
Titanium	....	0.20
Silicon	....	0.5
Iron	....	0.7
Other elements	....	0.05 ea.
Other elements	....	0.15 total

Aluminum—Remainder

These materials were developed too late in the war for wide-scale use in aircraft. They possess twice the yield strength of ordinary structural steels, resist stress-corrosion cracking and are probably the strongest commercial aluminum alloys now in production. As a consequence, they are expected to have widespread application in peacetime aviation and structural uses. Forms available are extrusions and clad sheet.

Another high-strength alloy, 14S, was widely used for aircraft forgings, but now is also available in clad sheet form. The strength of 14S lies intermediate between 24S and 75-S, and its good forming properties should prove useful in numerous assemblies. A comparable material is Reynolds R301 alloy.

Another duplex product, Alclad 3-S, was used for aviation gas tanks during the war, and is now available in the form of pipe for peacetime uses, notably in the chemical industry.

Tests were started in 1936 on the use of aluminum as a bearing material. After interruptions, a permanent mold casting alloy, 750, was introduced late in 1944. This alloy will find its place in the form of inserts for connecting-rod and crankshaft main bearings of high-duty internal combustion engines.

For the architectural field in particular, but also for other fields where the requirements are high resistance to corrosion and discoloration, there has been developed an extrusion material known as 63S.

Another newly developed alloy is A-100, a casting material designed primarily for rotors of electric motors, where low resistance is important.

The application of aluminum alloys depends not alone upon availability of new alloys. Forms and costs are important factors. The old two-high rolling mills in vogue before the war have largely been replaced with four-high mills. The key to this change lies in the development of a process for casting a metallurgically sound ingot of a size that can be used economically on the modern mills. So with economical, high-speed operation it is now possible to roll a sheet more than a city block long in one piece. Production of larger sheets has made possible a decrease in cost, which will be felt in a number of peacetime products.

Larger bars and rolled shapes can also be produced. Similarly extrusions have increased in maximum size—now 17 in. in diameter and weighing 550 lb., as compared to a prewar maximum of 12 in. in diameter and 400 lb. Stepped extrusions were successfully produced during the war to save machine work upon tapered spar caps for aircraft wing beams. This process is now available to produce extrusions for any part that must have a smaller cross-section at one end than the other.

Permanent mold castings have increased in size. Before the war a casting about the size of a derby hat was the maximum; now one weighing 100 lb. or more is feasible. An example is a piano plate 4½ ft. long by 4 ft. wide. Porosity and other defects resulting from moisture have been brought under control by development of a method for controlled-atmosphere casting.

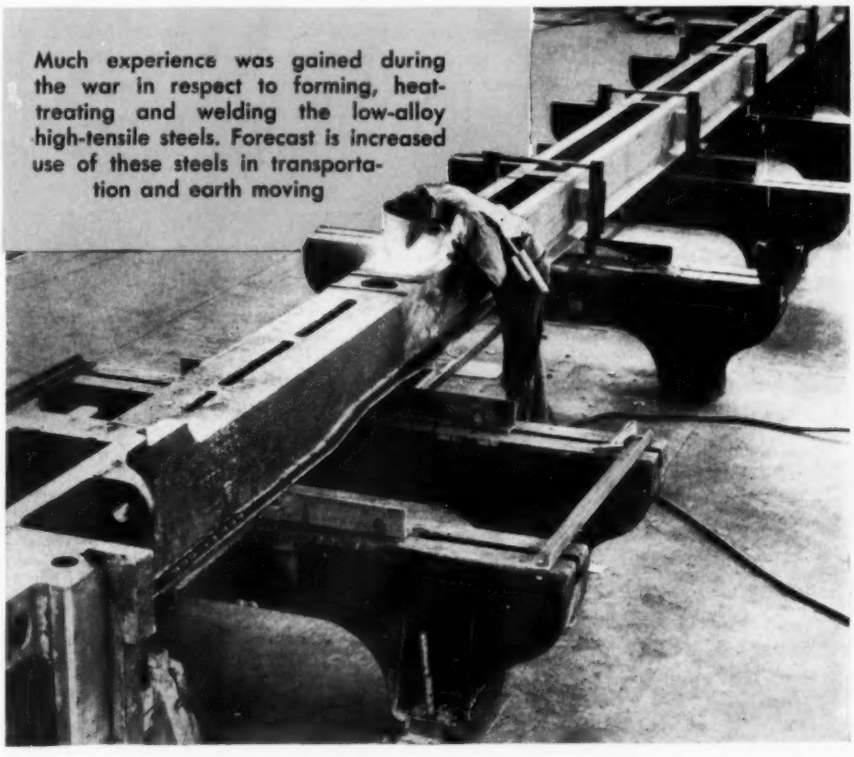
The enormous production of aluminum during the war and the existence of huge stocks of military aircraft rapidly becoming obsolete will give provide a large supply of secondary aluminum. This material will not have the same composition as prewar secondary aluminum, but can be worked successfully. The cost of secondary aluminum is expected to make it attractive for many purposes, especially casting and die casting.

Magnesium Made in Many Alloys

Production of magnesium increased more than 50-fold during the war years, and considerable research was found necessary in respect to processing operations such as casting, diecasting, presswork, forging, welding, heat-treating, cleaning and finishing. Interest in the material is attested by this fact: over 100 metal producers, rolling mills, foundries and fabricators are members of the Magnesium Association.

Present commercial alloys consist of magnesium alloyed with aluminum, manganese and zinc. These alloys are adaptable to casting, extruding, forging, rolling, forming, spinning, riveting and welding.

It is possible that magnesium stands now where aluminum did after World War I. Castings will undoubtedly be an important peacetime application: but it is known that the metal will be used in office equipment, toys, novelties, aircraft, hand tools, machinery parts, automobiles, rolling stock. The



Much experience was gained during the war in respect to forming, heat-treating and welding the low-alloy high-tensile steels. Forecast is increased use of these steels in transportation and earth moving

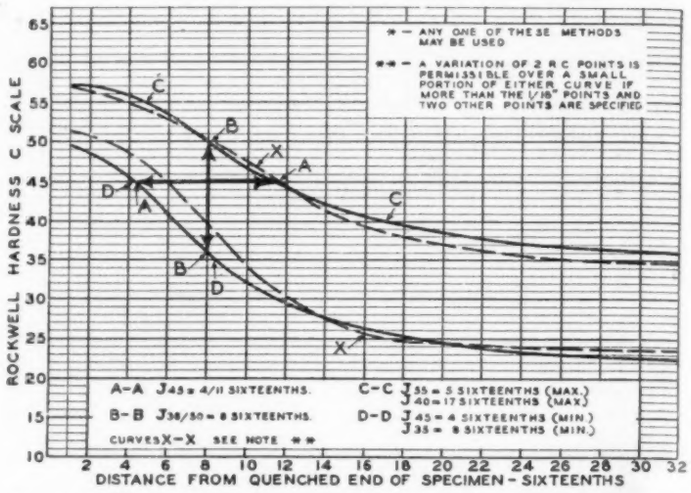
Hardenability Bands in Steel Specification

IT HAS been learned that the standard end-quench hardenability test (Jominy test) is more reliable than chemical composition for predicting the mechanical properties of alloy steels. So tentative hardenability bands have been established for a number of the constructional alloy steels. These bands apply to fine-grain steels with modified chemical ranges as shown by the suffix H. When making use of the hardenability bands for specification purposes, two points on the curves should always be used. Several methods of designation are possible.

Refer to the chart at right:

1. Minimum and maximum distances from the end of the standard end-quench bar at which the desired hardness occurs, as at *A-A*.
2. Minimum and maximum hardness values at any desired distances, as at point *B-B*.
3. Two maximum hardness values at two desired distances at point *C-C*.
4. Two minimum hardness values at two desired distances, as at points *D-D*.
5. Any point on the minimum hardenability curve and any point on the maximum hardenability curve.

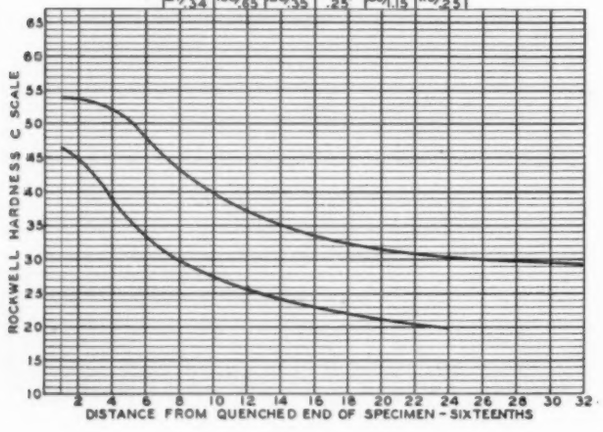
Tentative hardenability bands are shown for the 4100- and 8700-series steels in two carbon ranges. These two series of "triple alloy" engineering steels are competitive.


* — ANY ONE OF THESE METHODS MAY BE USED
** — A VARIATION OF 2 R C POINTS IS PERMISSIBLE OVER A SMALL PORTION OF EITHER CURVE IF MORE THAN THE 1/16" POINTS AND TWO OTHER POINTS ARE SPECIFIED
ROCKWELL HARDNESS C SCALE
DISTANCE FROM QUENCHED END OF SPECIMEN - SIXTEENTHS
A-A J45 = 4/11 SIXTEENTHS.
B-B J36/50 = 8 SIXTEENTHS.
CURVES X-X SEE NOTE **
C-C J35 = 5 SIXTEENTHS (MAX.) J40 = 17 SIXTEENTHS (MAX.)
D-D J45 = 4 SIXTEENTHS (MIN.) J35 = 8 SIXTEENTHS (MIN.)

Hardenability bands can be used in several ways when specifying desired limits for the physical properties of an alloy steel

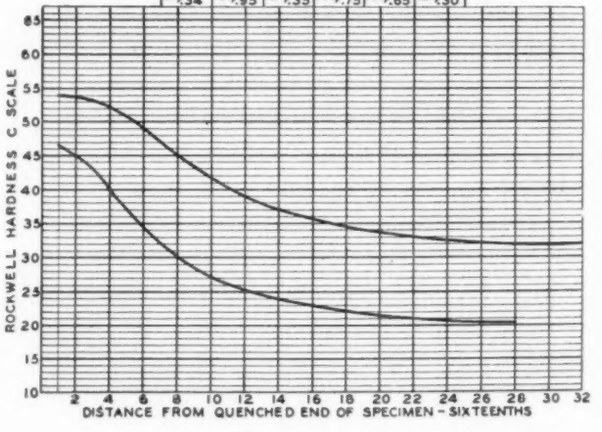
TENTATIVE HARDENABILITY BAND 4130 H

C.	Mn.	Si.	Ni.	Cr.	Mo.
.27/.34	.35/.65	.20/.35	Max. .25	.80/1.15	.15/.25



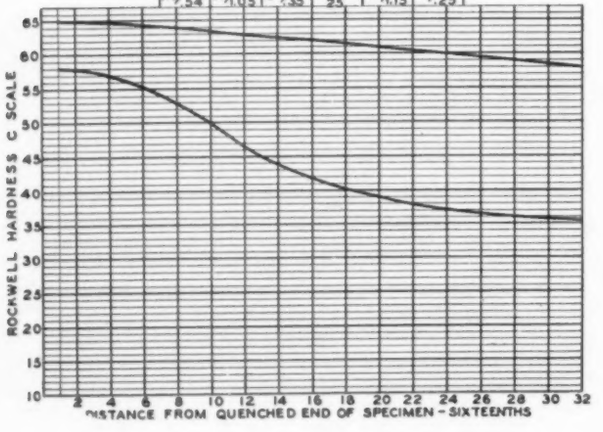
TENTATIVE HARDENABILITY BAND 8730 H

C.	Mn.	Si.	Ni.	Cr.	Mo.
.27/.34	.60/.95	.20/.35	.35/.75	.35/.65	.20/.30



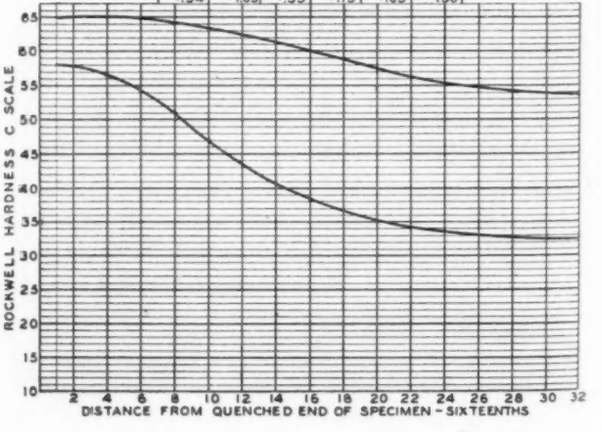
TENTATIVE HARDENABILITY BAND 4150 H

C.	Mn.	Si.	Ni.	Cr.	Mo.
.46/.54	.70/1.05	.20/.35	Max. .25	.80/1.15	.15/.25



TENTATIVE HARDENABILITY BAND 8750 H

C.	Mn.	Si.	Ni.	Cr.	Mo.
.46/.54	.70/1.05	.20/.35	.35/.75	.35/.65	.20/.30



metal is available in the form of rods, bars, forging stock, extrusions, shapes, tubes and sheet and plate from several sources. Industrial applications are in the formative stage, as with many other materials, but will probably grow as designers and shops become more familiar with the exceptional strength-weight ratio of the material and its potential savings.

With the proper tools and techniques, magnesium alloys are forged, formed and machined with ease. Any design of forging that can be produced commercially in steel or aluminum can be produced in magnesium. In fact, complicated forgings have been produced without trouble in brass-forging dies. Draft angles and dimensional tolerances are the same as used for aluminum but fillets should be larger.

Ability to withstand deep forming in one operation is an important characteristic of magnesium. Sheet stock must be formed in a warm condition; plasticity reaches a maximum at 600-650 F. Reductions up to 60 percent have been made in a single double-action drawing operation. However, much forming can be done at lower temperatures, for example at 200-225 F. or below the recrystallization point. Jobs that require five draws in brass can be done in magnesium in one operation. The metal can be worked about as fast as other materials and spring back is not a factor. Shear cracks can be avoided when blanking or piercing gages up to 1/16 in. by reducing the clearance.

Welded assemblies can be produced by arc, torch or automatic machines and all types of joint can be made. An inert-gas atmosphere gives the best results. Shape distortion may be more severe than with other metals, but is avoided or controlled by application of heat and pressure with ironing pads to relieve internal strain.

In corrosion resistance, magnesium is superior to iron and some aluminum alloys. Under ordinary atmospheric conditions, some magnesium alloys discolor and oxidize. Recent improvements in other magnesium alloys have greatly increased their corrosion resistance. A zinc-chromate primer is ideally suited to combat the slightly alkaline nature of magnesium oxide, but other primers may be developed soon. Paint, lacquer and synthetic resins adhere strongly to properly primed material. Much work has also been done with anodic finishes. These may be dyed (see cover).

Powder-Metal Parts

The scarcity of non-ferrous materials during the early stages of the war forced manufacturers of powder-metal, or oil-retaining, bronze bearings to shift to iron for many purposes. This usage proved so satisfactory that impetus was given to manufacture of structural parts from bronze, iron and steel by powder metallurgy. The motive was to save labor, machine-tool use and cutting tools, particularly on smaller, difficult-to-machine parts.

Under peacetime conditions, commercial considerations prevail. The die cost is high, production runs must be able to absorb the extra expense for material and tools. So while structural parts will continue to be made in quantity, their specification is most likely if there are additional favorable factors besides the avoidance of difficult machining operations. Powder-metal parts that are as dense and strong as products made by casting or forging are unusual. Controlled porosity is then a valuable feature, because the piece may be of odd shape and yet have lubricating qualities. Thus, special needs can be satisfied.

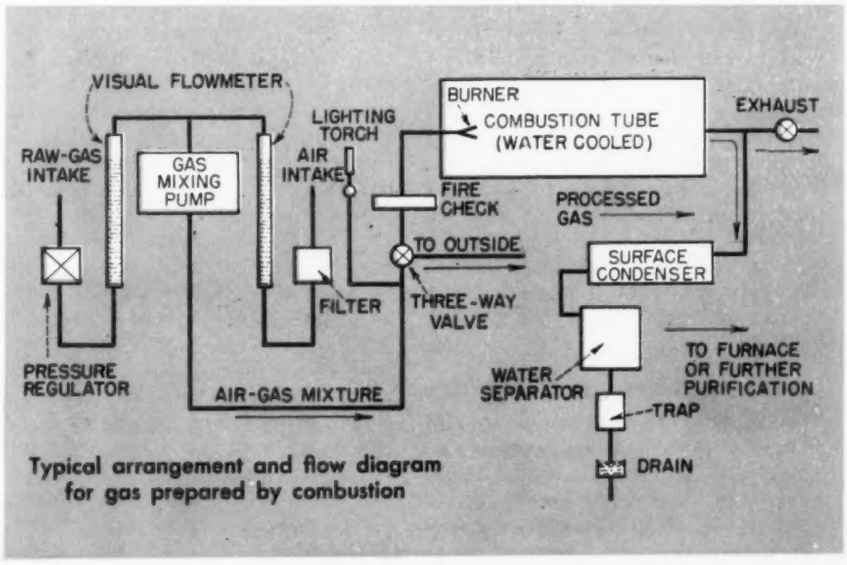
HEAT-TREATING

HEAT-TREATING HAS COME a long way since the old-time tool hardener thrust a chisel into an open forge and quenched it in a bucket of water. While today's objective is identical—to develop the most desirable physical characteristics in metal being treated—the method is different. Modern heat-treating is a precise metallurgical operation, conducted with the care employed in a chemical laboratory. In fact, heat-treatment, in nearly every case, entails chemical change and thus deserves the close control of a chemical process.

Developments in heat-treating have been in the processes themselves and in the equipment designed for the purpose. The two go hand-in-hand since one executes the plans of the other.

Take prepared atmospheres for instance. Air has long been recognized as a contaminating influence in heat-treating. It oxidizes and decarburizes the surfaces of heated metal parts. It produces scale and corrosion that has to be removed by expensive subsequent processing. Its bad effects have long been known and in recent years have been counteracted by the use of man-made atmospheres. But it was not until the exacting demands of the war put still greater emphasis on the need for optimum characteristics in metal parts that these gases really deserved the term "prepared atmospheres."

Prewar combusted gases used as furnace atmospheres invariably contained two to three percent of carbon dioxide and water vapor. Now atmospheres consisting of nitrogen,



Typical arrangement and flow diagram for gas prepared by combustion

TYPE OF PREPARED ATMOSPHERIC GAS	METAL TO BE HEAT-TREATED				
	COPPER	LOW CARBON STEEL-UP TO 0.20 C	MEDIUM CARBON STEEL 0.20 TO 0.600	HIGH CARBON STEEL ABOVE 0.60 C	SPECIAL STEELS
CO_2 CO H_2 H_2O N_2	Bright Anneal				
CO_2 CO H_2 CH_4 H_2O N_2		Bright Anneal	Up to 30 min. Exp Bright Anneal Clean Harden		
CO_2 CO H_2 N_2	Bright Anneal	Bright Anneal	Bright Anneal Clean Harden	Bright Anneal Clean Harden	
CO_2 CO H_2 CH_4 H_2O N_2		Carburize	Carburize Bright Anneal Clean Harden	Bright Anneal Clean Harden	
CO H_2 CH_4 N_2		Carburize	Carburize Bright Anneal Clean Harden	Bright Anneal Clean Harden	
CO H_2 N_2		Carburize	Carburize Bright Anneal Clean Harden	Bright Anneal Clean Harden	Clean Harden Tungsten Moly. Steel
H_2 N_2					Bright Anneal Stainless Steel

Composition of typical furnace atmospheres and their uses on various metals

hydrogen and carbon monoxide are obtained in commercial practice, other constituents being permitted only where their presence is not harmful. Prepared gases today are being tailor-made for the particular duty they are called upon to perform. By their use bright annealing, clean hardening and carburizing may be performed effectively and rapidly.

Steel that has been drawn, rolled or otherwise worked hot or cold must invariably be annealed to restore it to condition for further use. When the operation is done in uncontrolled atmospheres, scaling results, and the metal must be pickled or sand-blasted to produce a clean surface. Bright annealing eliminates this step and gives a surface just as clean as when the metal went into the furnace. In stress-relieving castings, forgings or stampings subjected to deep drawing, decarburization is prevented by the use of prepared atmospheres. Thus a cause of soft spots in the finished product is avoided.

Case Depth Fixed by Atmosphere

An outstanding development in prepared furnace atmospheres is the widened use of gas carburizing. While the process has been practiced for many years, it has recently become the subject of accurate control as to the depth of case and composition. Gas carburizing has reached a point where the case can be predetermined to a few points of carbon and a few thousandths of an inch in depth. In general, time and temperature determine the depth of case, while the kind of atmosphere controls the carbon content.

The knowledge of how to prepare a gas with a given carbon pressure has had far-reaching results. By this means the art of skin recovery has evolved. This process transfers carbon from the prepared atmosphere to a decarburized steel surface until a carbon balance is attained between the atmosphere and the steel. When the desired balance is reached, the process stops automatically and no carbon is added above that established by the carbon potential of the atmosphere. Steels that have been so treated show no line of demarcation between the original carbon content and that which has been added to the decarburized surfaces. The process has been found satisfactory for most alloy steels as well as for carbon steels. Nickel and silicon-manganese steels as well as those containing chromium, molybdenum and vanadium have been found suitable for complete carbon restoration.

The process differs from carburization in that it restores carbon to surfaces in which the carbon content has been reduced below that of the original material. Carburizing on the contrary adds carbon above the normal amount already existing.

More Mechanized Furnaces Used

In prepared atmospheres, nitrogen, carbon, dioxide, carbon monoxide, water vapor, hydrogen, methane, and in some instances small traces of oxygen are most commonly found. All of these gases with the exception of molecular nitrogen will react with steel. Their primary effect on various metals is given in the accompanying table. Prepared atmospheres may be used in connection with a great variety of heat-treating equipment. They fit into the batch-type furnace as well as the various forms of mechanized continuous furnaces that are growing more popular every day. In fact, mechanization is a definite trend in all types of heat-treatment. It facilitates work handling and gives closer control of heating and cooling cycles.

Common types of mechanized furnaces are the roller hearth, the chain grate, the rotary and the pusher types, all of which come in a wide variety of sizes and design. The roller-hearth furnace has an advan-

tage over other continuous furnaces in that the net load to gross load ratio is kept high. In the pusher-type furnaces the trays, and in the chain grate furnaces the grate itself are subjected to heating and cooling as well as the work load. In roller-hearth furnaces the rollers remain in one spot and are kept at uniform temperatures while performing their function of advancing the workpieces.

The net load to gross load ratio is important in view of the tendency to use more expensive furnace fuels —gas and electricity as against oil and coal—which while often higher in price have advantages in ease of control. If any lesson has been learned during the war it is that end results in high quality and low loss due to spoilage are worth the expense of initial installation and even higher operating costs.

In addition there are the pit type and the bell type furnaces which, while not continuous, have the merit of compactness and savings in floor space. In bell-type furnaces the portable cover with its heating elements, thermocouple and prepared atmosphere connections may be removed from one base to another, thus saving time in stacking the furnace load as this can be done while the bell is being used to heat the load on another base.

Improved Design Avoids Leaks

Furnace design has been improved to avoid dilution of prepared atmospheres by outside air. This obviously means tight joints. Sound construction and use of gaskets and liquid seals together with close-fitting doors, prevent contamination of the atmospheres.

In considering furnace tightness, the separation of the combustion chamber from the work chamber containing the prepared atmosphere is as important as protection from the outside air. Formerly muffles were widely used for this purpose, but more recently they have been confined to smaller sizes of equipment. In electric furnaces the problem is simplified because the heating elements have no products of combustion that would contaminate the atmosphere. Gas-fired furnaces now lean toward radiant-tube construction whereby the gas is burned entirely within individual tubular elements. Diffusion combustion is obtained by admitting air and gas at the burner end of the tubes in such a way that they will travel in parallel formation without turbulence. The diffusion between the two results in gradual combustion, so that the flame extends virtually the entire length of the tube. A uniform temperature results. The heating element is kept under a negative pressure, and this gentle suction makes it unlikely that the products of combustion will escape into the furnace, even though a leak develops.

Attention has also been given the need for shortening the time between the moment the work leaves the heating chamber and its transfer to the quench. This is sometimes done by having the quench inclosed with the furnace. One way is to locate a chamber just above the quenching bath so that the work can be dumped into the quench through a shrouded inclosure without contact with the air. Furnaces are also equipped with antechambers which are purged of air before the door to the heating chamber is open.

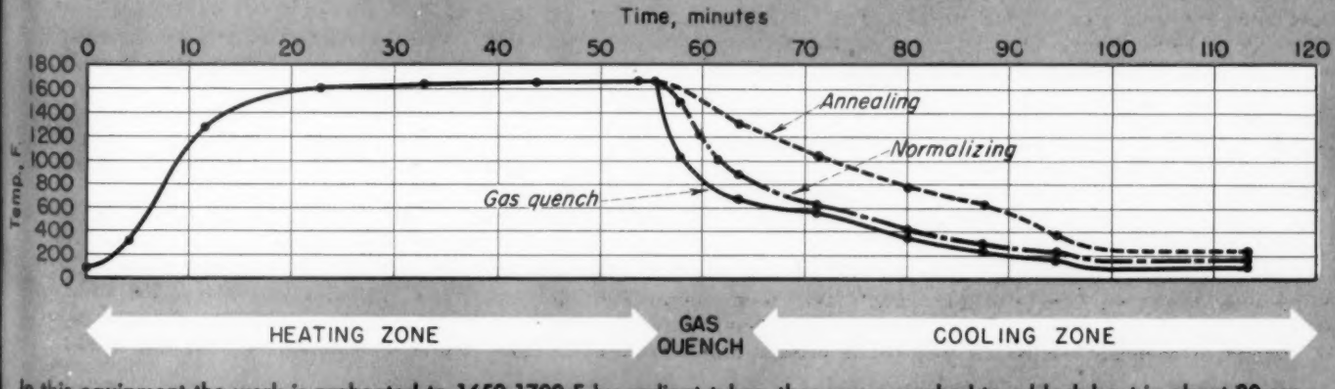
More exact construction of the quenching bath has come as a corallary to closer control of the heating conditions. Engineers now figure carefully the exact speed and volume of quenching fluid that must flow past a workpiece and the direction it should take. If the installation takes a tank car of oil and certain sizes of pumps and intercoolers, these are provided. Often in the past such considerations were left entirely to rule of thumb and inadequately provided for. Because of the studies that have been made on quenching, batch quenching in larger loads is now possible. Uniformity in hardness is also assured.

Dry Cyaniding and Gas Quenching

Another process using prepared atmospheres is dry cyaniding. The atmosphere contains carburizing gases and ammonia mixed to react entirely within the heating chamber. Usually the process is carried out in a continuous furnace. While it is possible to quench the workpieces, a quench is not necessary for producing extremely hard surfaces by this process. The use of a cooling zone without liquid quench will give glass-hard surfaces that resist wear but not heavy impact. Thin parts of sheet metal such as gun clips were successfully treated by dry cyaniding during the war. There are many small parts of this kind, including those formerly cyanided, that can be given this treatment. An advantage of the all-gas process is that the parts will not twist out of shape as they do in a water or an oil quench.

Quick cooling, without liquid quench, is not confined to dry cyaniding. In fact the "gas quench" as it is called, provides a new technique that promises a wide range of application in products made from thin-walled tubing, strip or wire. In thicknesses up to an eighth of an inch, high and low carbon steels, with or without alloys may be gas quenched. Accelerated aging may be performed on certain steels immediately following the bright gas quench, further to improve their physical properties.

Gas quenching or superfast cooling provides large quantities of cold gases issuing from a series of high-velocity



In this equipment the work is preheated to 1650-1700 F by radiant tubes, then gas quenched to a black heat in about 30 sec. The cooling zone further reduces the temperature to below the discoloration point

nozzles located above and below the material. After absorbing the heat from the work load the gases are cooled by passing them over water coils. Circulating fans deliver the cooled gases back to the nozzles. By this process the workload is quenched to a black heat in 30 seconds to one minute, depending on the size and thickness of the material. It then passes into a cooling zone where the work is cooled below the discoloration point.

Nitriding expanded rapidly during the war years because of its advantages in giving a fine degree of wear resistance at a comparatively low temperature. In general there was little change in the technique. An exception, however, was the application of nitriding to stainless steels. It was found that virtually all grades of stainless steel could be nitrided successfully, which meant an expansion of the process into a new field of application.

Quench Time Critical for Aluminum

In the solution heat-treatment of aircraft parts, the critical characteristic of aluminum alloys had to be recognized. If these alloys are permitted to cool slowly from their furnace temperature (about 950 F.) crystals start to form and alloying elements begin to segregate as they are precipitated from solid solution. Since many of these aircraft parts are made from sheet metal, it is necessary to transfer them to the quench tank quickly to avoid air cooling. Ten seconds is a greater time interval than desirable, and 20 seconds is dangerously long. Consequently, special handling has to be employed.

One method is to lower the work charge into the quenching tank from the heating chamber, vertically above it, by means of an elevator. Another way is the use of quenching spray booths. Some of these booths are portable and can be rolled from one furnace to another. Others have the spray booth and furnace built as one continuous unit so that the work can pass from the heating chamber to the quench without exposure to the air. In each case the objective is to cut time of transfer from the heating to the quenching chamber to a few seconds.

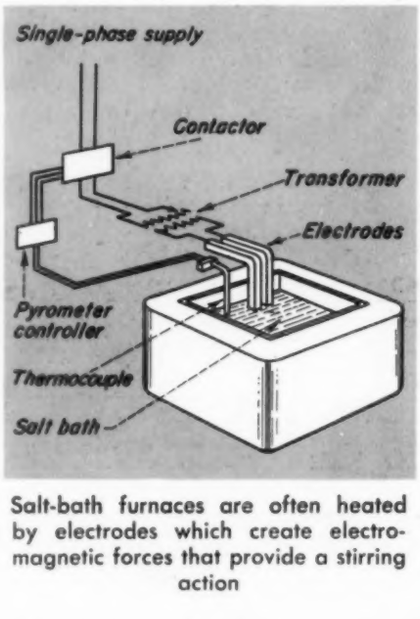
Still another advance in furnace design is the application of convection heating to high-temperature furnaces. Before the war circulatory fans were rarely used above 1850 F. Now they are applied at temperatures as high as 1900 F. Use of the fan gives more rapid and uniform heating of the work charge; consequently, larger charges can be used for a given furnace. Convection heating is applicable to many designs of furnace and is nearly always used with pit and bell-type furnaces. At the lower temperatures the use of forced convection is important because with the dull colors produced there is little radiant effect.

Extended Uses of Salt Baths

An excellent way to exclude the effects of air on the workpieces is the employment of salt baths. The popularity of this type of equipment has increased greatly during the war years and no doubt will continue to do so in the future. The advantages are uniform and rapid heating, small space required for an installation, and the opportunity of quenching metals at elevated temperatures to give excellent physical characteristics with a minimum distortion. Salt-bath treatment is used for hardening, annealing and brazing. Either neutral or carburizing salt may be used.

Salt baths are used in the spheroidal annealing of steel, a process which has been developed to control the grain structure in a way that will facilitate machining. Salt-bath annealing is also widely used on brass, stainless steel and aluminum alloys.

The most important development in salt bath treatments is called the isothermal hardening of steel. This is done in a neutral bath under processes known as austempering and martempering. In general these methods comprise heating the steel until it is substantially austenitic and then quenching it in a heat-abstracting bath between 350 and 800 F. In the austempering process, steel is held at the chosen temperature until transformation is substantially complete and then cooled to room temperature. In the martempering process the steel is held in the bath until the start of the transformation when it is cooled to room temperature by means of an oil quench. In either case the steel develops properties that are not obtainable in the conventional quench and temper method of heat-treatment. At the same hardness they have greater ductility and toughness, and higher resistance to fatigue.



Salt-bath furnaces are often heated by electrodes which create electromagnetic forces that provide a stirring action

It is likely that full advantage of salt-bath treatments have not yet been realized. By this method equivalent hardness can be achieved without the danger of cracking or excessive distortion. Thus, it is possible to use lower alloy steels by increasing the carbon content. In many cases grinding allowances can be reduced, giving economies in machining. The reduction of distortion in the workpiece produces a more uniform product; hence any finishing operation will remove the same amount of metal all around. To the economies in machining may be added increased grinding wheel life.

Since carburizing, nitriding and cyaniding may also be done in the salt quench, it is possible in some cases to combine higher surface hardness with the over-all heat-treatment of the workpieces.

The salt bath can also be used for hardening high-speed steel tools and is especially useful on taps and dies, where distortion and incipient cracks may prove disastrous.

During the war salt bath heat-treatment was done on shells from 37 to 155 mm. This process was also employed on fuses in order to give them resistance to withstand the tremendous impact of the striking projectile. Other wartime uses were on rocket tubes and armor plate.

Salt bath heat-treatment in its various forms will find wide postwar application. It is now being used on automobile bumpers, carburized alloy gears, knives, lawn-mower blades, carburized crankshafts, and on a wide variety of business-machine parts.

Selective Hardening by Induction

High frequency induction heating moved into prominence during the war years. It can be used for soldering, brazing, annealing, stress relieving, surface hardening and melting

all types of metals and alloys. A great advantage of the process is its ability to harden selectively, which leaves other surfaces soft and thus greatly reduces the possibility of distortion. The high-frequency current needed for the process is obtained by motor-generator sets, by spark gaps or electronic tubes. Within certain limits the higher the frequency the more superficial the hardness that is obtained. Accordingly the frequency is selected with consideration of the size and shape of the work being processed.

While theoretically induction heating is an expensive form of heat generation, only the portion of the work that is to be brazed or hardened need be heated. The workpiece is simply placed inside an induction coil and heated by the eddy currents set up in it without any physical contact with the source of heat. In hardening, the quenching is usually done by a spray built into the hardening fixture and keyed to the heating and quenching cycle. The cycles are short, taking only one to two minutes on moderate sizes of work.

Ordinarily the workpieces are handled one at a time, but multiple coils have been designed to process more than one part simultaneously. Engineers are learning something every day about coil design for induction heating, and the efficiency of the operation is controlled by ingenuity in this direction. Economies can often be obtained by mechanical handling of the parts, and where quantities warrant, coils can be made for progressive feed through them.

The ability of high-frenquency induction heating to place the heat where it is needed is of great benefit in soldering and brazing operations. Another attractive feature of the process is that the time cycles are automatic and once they have been determined an unskilled operator can run the equipment.

WELDING

DURING THE WAR many things were joined by welding, from the tiny filaments of electronic tubes to the plates of battleships. The know-how of welding was spread through this experience to many companies not familiar with the process before the war, and to many workers trained to become welders.

Gas welding, usually employing the oxyacetylene flame, is the oldest process and still finds wide use, although for certain kinds of work it has yielded to one of the forms of electric welding. This is not to say that the use of the oxacetylene has diminished, for what it has lost in welding it has more than made up in other applications such as cutting, brazing, flame-hardening and descaling. Gas welding is still useful on light gages of metal and in places where portable equipment must be used.

Pressure welding, a new development in the oxyacetylene process, is used for making butt joints. The two faces to be welded are thoroughly cleaned and then forced together under pressure while being heated by a number of oxyacetylene flames. The material becomes plastic upon attaining the welding temperature and is upset by the applied load. The joint is as strong and ductile as the base material and of identical chemical composition since no outside material is added to the butt weld.

Pressure welding has been used successfully on forged, cast, and rolled steel. It has been applied to overland pipe lines, railroad rails, boiler and heater coils, oil-well drill stems, pressure tanks, and airplane landing gear struts. The process is a fast one.

Gas welding in common with other methods of metal fusion lends itself to mechanization. The torches may be motor driven on a track along the seam with or without the addition of filler rod, according to the demands of the job. The method has been used in making steel ammunition boxes.

Electronic Flame Cutting

The oxyacetylene process affords a low-cost and effective means of cutting steel plate and beveling the edges to make the proper joint. Equipment for the purpose has been the subject of recent improvements. Straight and circular cuts can be made by self-propelled carriages which move the torch along the desired path. Pantograph arrangements are made to follow templets in order to cut irregular contours. One or a number of torches can be set up on a common beam to follow the same path.

One variation of the flame-cutting machine is provided with an electromagnetic follower which keeps in contact with a suitably prepared templet. A more recent improvement provides an electronic device which will follow a line or a silhouette on a piece of paper, thus eliminating the

An 18-8 spout for a cream separator is welded by the inert-gas process. Helium, first employed on magnesium, thus finds a new use

templet entirely. The cost of preparing drawings and silhouettes is low, and they are easily stored. The electronic tracing head provides a smooth corrective action as the spot tends to vary from its correct position, thus making it possible to cut more intricate sections than by other automatic methods.

Another variation of the cutting technique is employed on large billets and is known as hot cutting. Here the steel is preheated to facilitate the flame-cutting operation. The process is useful on large rounds and heavy plates; one application was to cut crankshafts for a 10,000-hp. diesel engine from plate 32 in. thick.

Flame cutting has recently been applied to stainless steel, previously thought to be uncuttable.

Underwater flame cutting facilitated the salvage of shipping at Pearl Harbor. This process has been improved recently and offers a method of speeding up underwater applications. While it is not necessary to use the same equipment, plate is sometimes cut under water in the shop to minimize distortion. The water is made to cover the surface a fraction of an inch, and the cutting flame is sufficient to push the water aside without impeding its cutting action.

Gas flame is used also for flame cleaning and dehydrating. Using a wide torch with a number of gas flames, it is possible to clean and dry a broad surface and make it ready for painting in quick fashion.

Arc Welds Shielded by Inert Gases

Arc welding is now the most widely used method of joining heavy materials. The war years saw a great advance in arc-welding methods, equipment and electrodes.

One of the outstanding developments was that of "inert" gas arc welding. It was long ago found that in most applications it is better to protect the molten weld metal from the air and to supply a flux to facilitate the metal flow. Electrode coatings of a wide variety were created for this purpose, and the process became commonly known as shielded-arc welding. Elimination of oxide from the weld gave tougher joints and proved to be a great boon to arc welding as a manufacturing tool.

During the war it was desirable to weld magnesium previously considered unweldable because of its combustibility. However, a way was found to weld this metal by protecting the arc with a gaseous envelope.

Helium and argon are the two gases commonly used, and these are blown around a tungsten or a carbon electrode. The process can be carried on with or without the use of filler wire.

Since the development of the process it has been used on aluminum, copper alloys, stainless steels, mild steel, monel metal and inconel. A particular advantage is that with argon gas and alternating current, aluminum can be arc welded without the use of a flux. Good welds ⅝ in. thick in aluminum have been made by this process.

The use of inert gas for shielding the arc was preceded by the atomic hydrogen process. Here, however, the gas is far from inert, burning with intense heat during the welding operation. Atomic hydrogen welding has proved advantageous on tools and dies. Both inert-gas arc welding and atomic hydrogen welding lend themselves to automatic operation.

Arc Welding Becomes Automatic

There was also a great growth in the use of automatic arc welding with solid coatings during the war. The advantages of automatic control to insure sound, uniform welds without dependence on the human element were attractive. Use of elctrodes in the form of a wire, fed from a reel, eliminates the loss of a stub end on each rod and also minimizes interruption of the process.

One necessity in automatic arc welding is to supply the welding current to the wire electrode while it is being fed into the arc. Obviously this can be easily done by means of brushes where bare rods are used. But where coated rods are used some method must be employed to get through the coating in order to supply the current.

One solution is to mill a narrow slot in the rod as it is fed through the rollers and to have electric contact fingers extend into this slot touching the bare metal. Another possibility is to use a light coating on a knurled rod, so that the coating material lies in the indentations, leaving sufficient exposed area on the rod to provide contact for the electric brushes. Still another method is to apply the coating in the form of a tape. Special taping devices have been designed to pass the electrode wire over a brush and then to wrap the tape carrying the welding flux around the wire just before it is fed into the arc. This method gives a heavy coating and full protection against oxidation. The tape can also be used to carry certain alloys into the weld, thus reducing the number of kinds of electrodes necessary to meet all requirements.

A process that received a great acceptance during the war is known as "submerged arc" welding. A powdered flux or "melt" is used here instead of a coating on the electrode itself. The equipment using this process pours the powdered flux through a funnel-like nozzle ahead of the fused metal. Since the flux when heated is in itself a conductor of electricity, it dispenses with the need of a flashing arc with its danger of spatter as the weld is formed. The flux also protects the fused metal from oxidation and removes impurities by forming a slag which rises to the surface of the weld. It covers and insulates the bead to give slower cooling, thus lessening the danger of internal strains. Alloys may be added to the melt just as they are to the tape. Uniform feeds and high current in automatic arc welding give it a rate of from three to ten times as great as for manual operation.

A recent development in electrodes has been the application of powder metals as a rod coating. In this way high alloys can be added to the surface of the rod and in turn surrounded by a second coating carrying the flux. It is possible in this way to weld stainless steel by adding the high nickel and chromium content in the form of powder metal to a carbon-steel electrode.

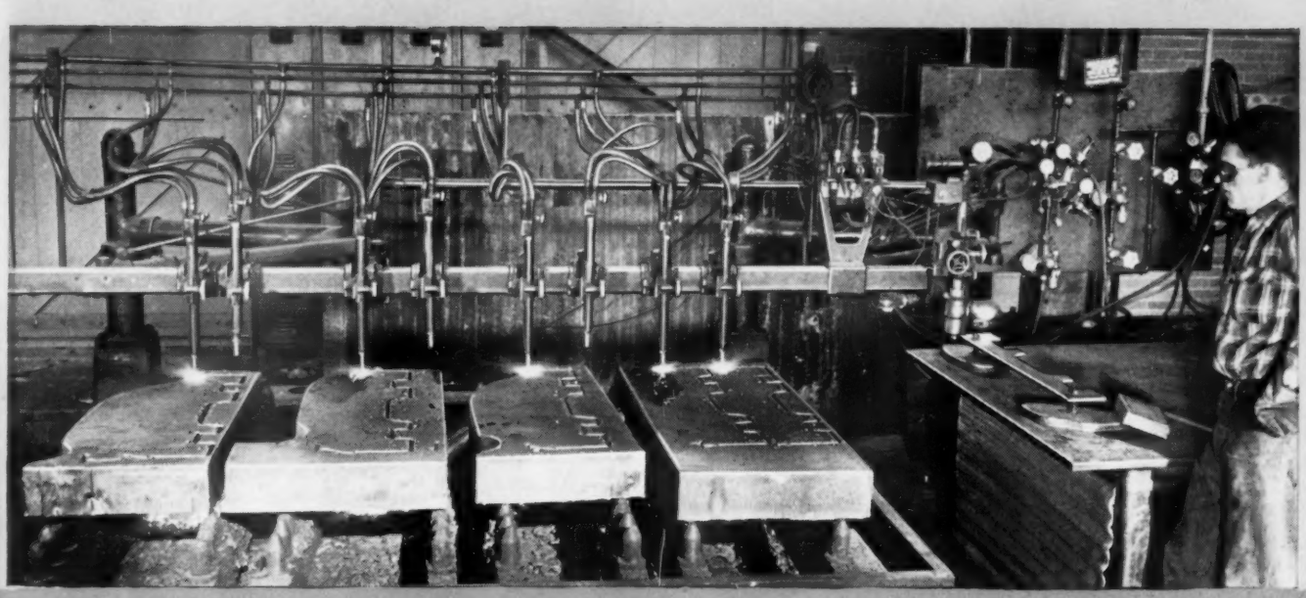
A. C. Welding Grows in Popularity

The first arc-welding machine supplied direct current, but in recent years alternating current welders have greatly increased in popularity. They possess advantages of eliminating arc blow and giving fast welding with low power consumption and low maintenance. However, in welding thin metals the a.c. arc becomes unstable and tends to go out easily which may spoil the weld. One solution is to superimpose a high-frequency current wave on the welding current.

Better Control for Resistance Welds

An outstanding development in all types of resistance welding is the more precise and systematic control of procedures. First, there is a considerable improvement in the control equipment on the machines, and, second, a better understanding of operating procedures and quality control programs.

The spot-welding of aluminum and aluminum alloys was of particular interest during the war because of its importance in the production of military aircraft. Successful applications



Locomotive frame pedestals, 5½ in. thick, are flame-cut in a setup using five torches. A magnetic tracing head at the end of the beam follows the templet on the table at the right

required better methods of cleaning aluminum parts for welding, satisfactory equipment for producing the high-amperage welding current and close control. There is no reason why this knowledge should not be put into wide use for peacetime production.

Success in aluminum welding depended on the development of the stored-energy system. Since aluminum takes a higher welding current than steel, enormous strains were made on the power lines until the storage method was developed. As the name indicates, this procedure takes energy from the line over a period of time and discharges it in a sudden surge to give the desired fusion. Aircraft skins and other parts were fabricated by this method. One type of equipment starts the energy in a bank of capacitors through a three-phase rectifier. Another stores the energy magnetically in a special transformer or reactor, again using the rectifier. Still another way of getting stored energy into welding units is through the use of storage batteries. Such equipment may be used where the power line capacities are not available for the high demand of conventional welders.

The double pressure system of spot-welding aluminum gives a second application of pressure to reduce sheet separation, surface indentation and cracking, and to improve electrode life.

The remarkable improvement made in spot-welding of light-gage aluminum sheet will undoubtedly continue to find application in the manufacture of aircraft in the future. There is also a large field of application in the manufacture of sheet-aluminum products such as furniture, partitions, tanks, containers, household utensils and probably railroad cars. Spot-welding was applied to some of these products before the war, but in many cases the result was not satisfactory and recourse made to riveting or some other method of metal joining.

Air-Hardening Steel Now Welded

Another class of material which was not spot-welded satisfactorily before the war is the group of so-called low alloy steels which are air-hardening. These steels are in great demand because of their high strength. Their spot-welding was made possible by the simple procedure of welding and then heat-treating the weld zone right in the machine. The available control equipment makes it possible to do this automatically, so that obtaining a satisfactory weld in these materials is merely a matter of making the proper settings on the control panel of the machine. This development has opened up the whole field of application of resistance welding to the assembly of component parts of hardenable steels.

In the case of spot-welding the hardenable steels, many applications will doubtless be found in trucks, earth-moving equipment and similar structures where these steels are used to reduce total weight without sacrificing strength.

The development of control equipment has also widened the range of usefulness of resistance welding to the assembly of heavier gages; that is, from ⅛ to ¼ in. It was always theoretically possible to spot-weld plate materials of any thickness, but there were economic limitations. Work which has been done indicates that good results can be obtained.

There has also been some important work done in the development of pulsation welding, a technique involving the application of more than one impulsive current with intervals between impulses when no current flows. This process has made it possible to spot-weld the heavier gages in a machine of considerably lower capacity than would be required if the weld were made with a single impulse of current.

Electrodes Are Refrigerated

Improvement of electrodes has parralleled rapid development of resistance welding equipment and procedures. More durable materials have been found and these are often water-cooled in order to keep their temperatures from becoming excessive. High heat will soften the electrodes and cause them to flatten or to pick up material from the workpiece. Still a further step is the use of refrigerated electrodes which are said in some instances to double the number of spots made between cleaning. Usually these are held at temperatures between ten below and ten above zero Fahrenheit.

Brazing In Production

During the war brazing graduated from its job as a shop handyman to a position in the production line. At one time the process was used primarily for tipping tools, repairing cutters and doing a few other odd jobs that seemed to lend themselves to no other method. But war necessity gave the process a big boost and tripled its usage.

Brazing divides itself roughly into high-temperature, or copper brazing, and low-temperature, or silver, brazing. The technique of the two is somewhat similar, and each process has its advantages. While the materials for silver brazing are somewhat more expensive, the low temperature of the process reduces distortion and simplifies the heating operation. As a matter of fact, silver brazing can use virtually any of the common shop methods for applying heat: the oxy-acetylene torch, the induction heating coil, the salt bath, the furnace (usually continuous), incandescent carbons, resistance welding equipment and gas-air burners.

One of the improvements in technique in all types of brazing is the pre-assembly of parts together with brazing material prior to heating. The silver or copper alloys can be placed in the assembly in the form of rings, blanked sheets, washers, wires or special shapes. Then when the assembly is heated, the material flows into crevices between the parts aided by capillary attraction to give a dependable tight joint. Many applications were found for the process during the war, and in some cases complicated assemblies containing dozens of parts were built up by brazing. Ingenuity in design made it possible to replace castings with these brazed assemblies.

To name only a few of the many products which were successfully brazed there were shell windshields, air speed tubes, switch boxes, terminal tubes, transformer parts, microswitch housings and many aircraft parts.

Both copper and silver brazing have already been applied to household refrigerators, oil filters, brake assemblies, and radio crystal units.

Brazing readily lends itself to automatic operation. Where quantities warrant, the chain belt furnace is simple and reliable. Induction heaters can be provided with automatic fixtures, and with a little ingenuity, tooling may be designed to simplify handling greatly. Where the operations are broken down to the preplacing of the parts and feeding them into heaters, little skill is needed.

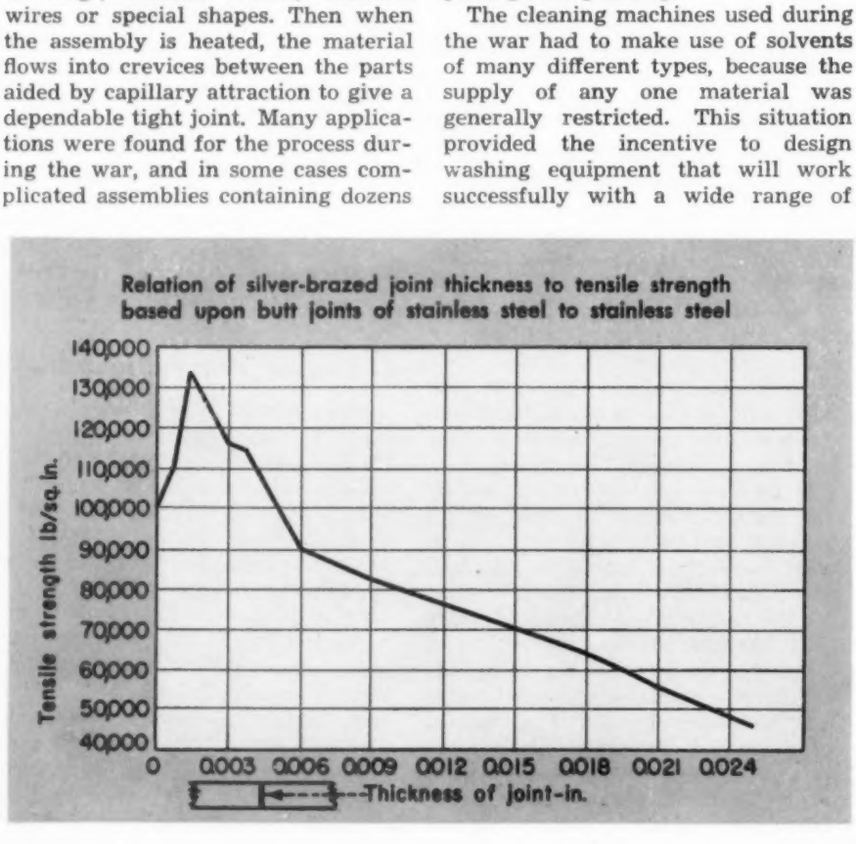
FINISHING

IMPORTANCE of thoroughness in metal cleaning was brought home to production personnel by specifications for military items. This work included not only the removal of oils and greases but also surface films by a kind of pickling. For example, the preparation of aluminum for spot welding required removal of oxides as well as soil. Aluminum treatments are probably the most spectacular illustration of the trend in metal-finishing thoroughness, but there was recognition also of its importance as a preliminary to electroplating and painting.

The cleaning machines used during the war had to make use of solvents of many different types, because the supply of any one material was generally restricted. This situation provided the incentive to design washing equipment that will work successfully with a wide range of detergents, whether solvents or alkalis. This has been accomplished not through radical methods but by more carefully engineered applications of the facilities to the job to be done.

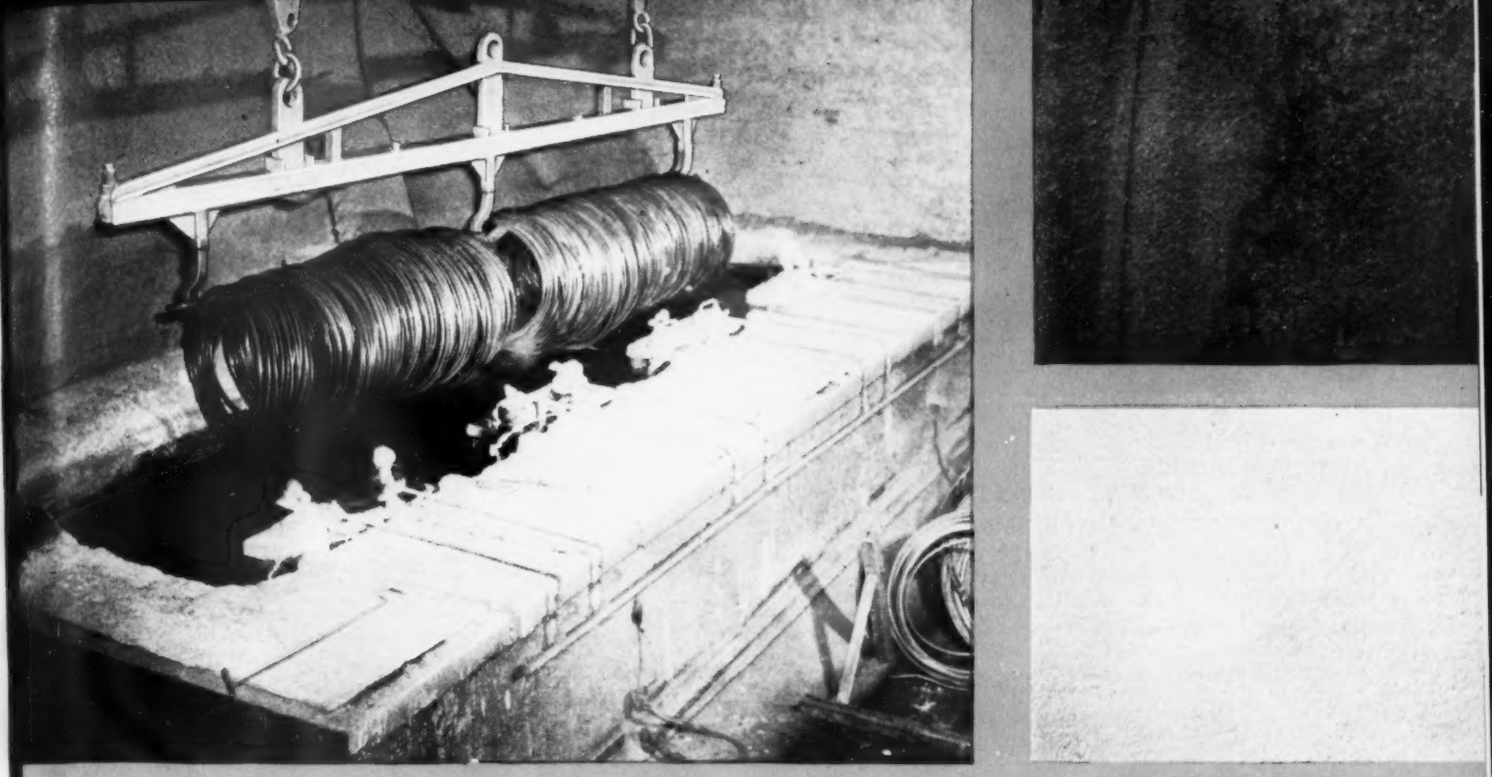
One of the important developments in metal-cleaning machines was the incorporation of rust-proofing in solvent degreasers. These units were generally immersion or spray-type conveyorized machines. Stabilized trichlorethylene solvent was used to clean aluminum, steel, magnesium, brass, and combinations of these metals in assemblies. At the end of the cleaning cycle, the parts were dipped in a rustproofing tank incorporated in the cleaning machine. This permitted parts to remain in stock before needed at assembly line.

Inspection of equipment after teardown, such as done with aircraft engines and diesel engines, was promoted by development of cleaning equipment and detergents for the purpose. The cleaning process must be thorough enough to permit ready inspection of the product's component parts and yet leave a slight residual film of oil on work surfaces to prevent rusting. In other words, thorough cleaning, in the sense of that required prior to electroplating, is not wanted. Machines involving power sprays of such substances as kerosene, at high pressure and from all sides of the work, successfully met teardown inspection requirements. There is continuing interest in this type of cleaning by makers of precision equipment.



Emulsion Cleaners Save Scrubbing

Shortages of chlorinated solvents speeded the development of emulsion cleaning materials. These have facility to penetrate soil on the work



Scale on stainless steels and other alloy steels can be removed without pitting or loss of metal. Sodium hydride, which is dissolved in fused caustic, reduces metallic oxides to loosely adherent form, and scale is blasted from the surface by the subsequent water quench. At upper right—stainless steel before the descaling operation; at lower right—descaled metal

—cutting oils, and buffing, lapping and drawing compounds—coating the particles with soap so that they can be flushed off with water. This action leaves a physically clean surface and avoids need for hand scrubbing or wiping. Some measure of temporary rust-proofing is achieved.

One of the latest developments is the use of emulsion cleaners in combination with alkali cleaners in a single-tank operation prior to electroplating and porcelain enameling. This bath is always used with a subsequent alkali bath which creates a chemically clean surface.

Emulsion cleaners have no action upon active metals: zinc, aluminum, lead, tin, copper and brass. The slight residual film left on the work does not interfere with applying paint or enamel.

These methods of application have all been used: (1) work dipped into concentrated precleaner and followed by pressure spray water rinse prior to electroplating cycles, (2) in conjunction with alkali cleaner and water as precleaner, (3) spray hot water-emulsion on the work, the self-dried parts being suitable for painting and enameling, and (4) soak in water emulsion and rinse.

One important effect of emulsion cleaners is avoidance of hand scrubbing to remove soil—for example, to clean drawing compound from stainless steel tubing prior to annealing.

Avoids Rusting in Process

Rusting of machined parts in process was a major problem during the war. Various steps were taken to avoid corrosion of highly finished surfaces from prolonged contact of soluble oils or exposure to atmospheric moisture. But much trouble and expense were eliminated by development of protective oil with remarkable ability to displace water solutions, even from deep recesses. This oil will also remove finger marks.

One of the major uses for this oil is to protect wet-ground parts. By plunging the pieces into an adjacent tank of protective oil, the water is literally flushed off the metal surface and expelled (even violently) from holes, and sinks to the tank bottom. An oily film, which is too thin to affect "miking," is left on the surface and will protect the article for months during inside storage. Thus, additional slushing and the expense of wrapping parts in protective paper are avoided.

Another slushing oil that prevents rusting of highly polished work in process is known as a fingerprint neutralizer. This product has a triple action: (1) it displaces water from machined parts, (2) it forms an oily film on the metal surface to afford protection for a period, and (3) it dissolves perspiration residues in fingerprints. Tanks of the oil placed alongside machine tools afford a quick protective dip at low cost, because coverage is 1500 sq. ft. per gal. The protective film does not interfere with application of a permanent type rust-preventive.

How Aluminum Is Cleaned

Surface preparation of aluminum prior to spot welding is essential in order to secure sound joints. The key to good welds is removal of surface oxides, ink-stamp marks and smut in order to lower the surface resistance. Wire brushing is one method, but is tedious. A chemical two-step process has given good results. In the first step, oils and inks are removed from the aluminum; in the second step, the oxides. The operation is carried out in tanks by using an alkaline cleaner and then an acid material. Chemical treatment in this fashion overcomes non-uniform resistance along the aluminum sheet and avoids welds of irregular quality.

Another development is a simple dip process to prepare aluminum surfaces for electroplating with copper, silver and other metals. Adhesion of plated coatings is as high as the rupture strength of the base metal. The treating times are short and the process is econonmical to run. During the war its use was largely for preparing aluminum surfaces for silver and gold plating for electrical contact purposes and for copper plating where

aluminum had to be soldered. Postwar uses are largely for decorative purposes, including silver, nickel and chromium plating.

Pickling Aids Save Metal

Various improvements in pickling were brought about during the war. In one case, a control material is added to 5-10% sulphuric acid to inhibit attack upon the steel or iron after rust and scale have been removed. The inhibitor saves metal, and restricts build-up of iron salts in the pickling solution so that the life of the latter is greatly extended. Acid is thus saved, the annoyance of dumping the tank is less frequent, fumes are reduced.

More Coatings for Metals

A one-dip, non-electrolytic process yields a corrosion-resistant finish on zinc or cadmium surfaces at low cost. The basic finish secured on surfaces plated with these metals or on zinc the castings is either olive drab or bronze, dependent upon the solution used. A related process yields a spangled finish on hot-dipped galvanized material. A measure of the corrosion resistance imparted to zinc plating or zinc die-castings by the process is seen in the absence of white corrosion products after 300 hr. exposure to salt-fog, whereas unprotected zinc surfaces do not withstand the test for 24 hr. Tests indicate that the process will at least double the life of galvanized material subject to outdoor exposure. Cost of the treatment is said to be 0.4 cent or less per square foot of metal treated.

The coating developed on zinc or cadmium surfaces has sufficient abrasion-resistant qualities to resist normal handling. If desired the coating can be left as is, or it can be dyed red, blue, black or green, using a secondary bath immediately following the rinse of the basic coating. Moreover, the coating provides a good paint base.

A process was developed for production of a molybdic-oxide coating upon zinc surfaces, by simple immersion in a solution of salts operated from 150 to 180 F. The coating is black and inert. It has been used largely as a base for paint and other organic finishes, but it is now being used rather widely for blackening zinc-base die-castings and other zinc surfaces followed with a protection of lacquer or wax. The process is now used for toys and other novelties made of zinc-base die castings, where it is more economical than plating.

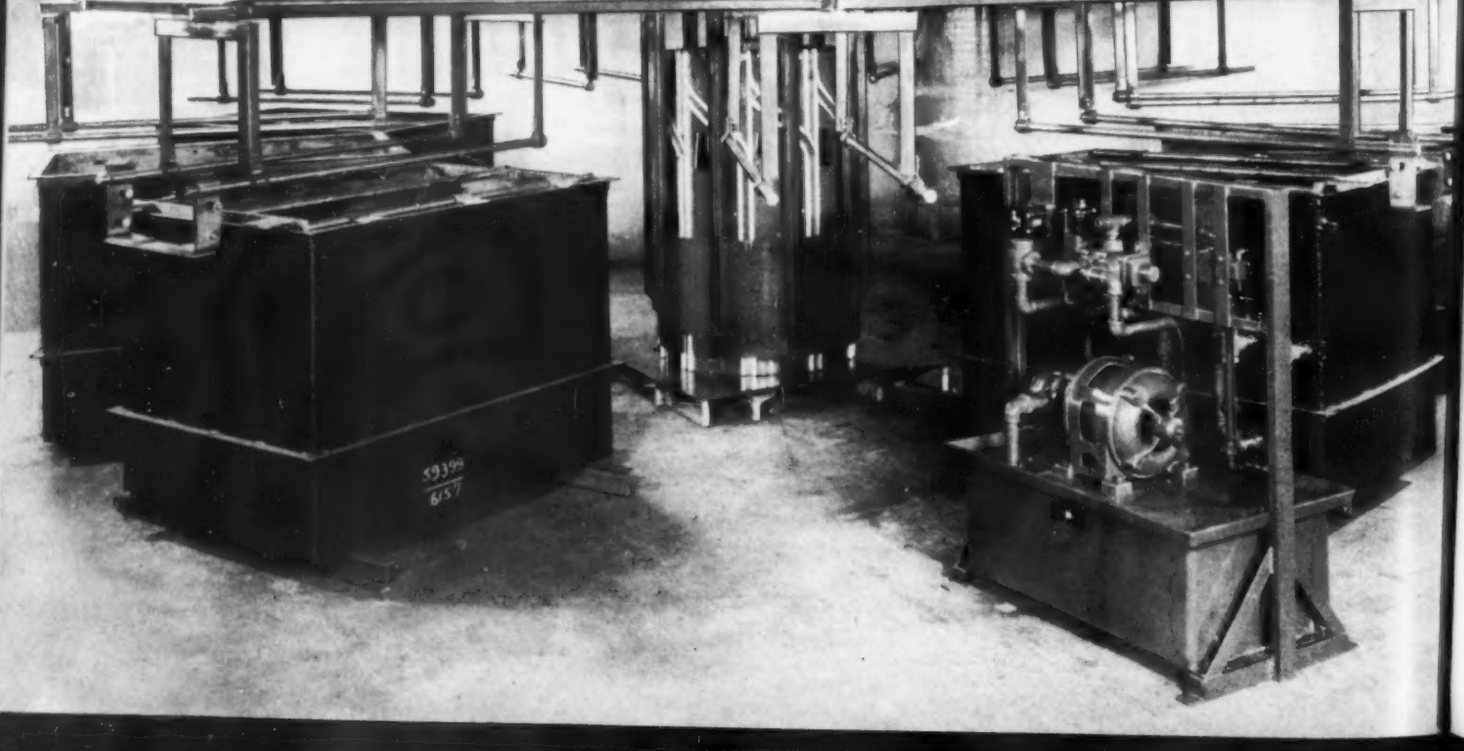
Strict standards were established for adherence of paint to steel ammunition cannisters. This requirement brought into being an acid cleaner that does three things: (1) cleans the metal, (2) deposits an iron-phosphate coating, and (3) prevents rusting until the steel article is painted. Under favorable conditions, the cost of the treatment is approximately 10 cents per 1000 sq. ft. of metal treated. Prospective peacetime applications of the coating are bicycles, automobile bodies, household cabinets, office furniture, painted sheet-metal objects in general. Incidentally there is no heavy buildup of coating on the cleaning machine surfaces or clogging of spray nozzles.

A process was developed for direct low-temperature oxidation of steel to produce a black ferro-ferric oxide coating. The operating temperature range is from 285-290 F. These black coatings have moderate resistance to corrosion and usually must be protected with oil, lacquer or wax. They are used fundamentally where a black color is desired or for enhancing the beauty of products. There has been considerable adoption of this process for treatment of postwar products largely by manufacturers in the optical equipment and electrical-equipment fields.

Paint Sticks to Aluminum

By a chemical oxidization treatment for aluminum, coatings are produced that resist corrosion and improve the adhesion of organic finishes. The treatment consists of immersion of the aluminum in a dilute solution

Plating has been raised to the status of a production process by development of machines. An "umbrella" type dips racked parts in appropriate tanks for whatever plating cycle is desired

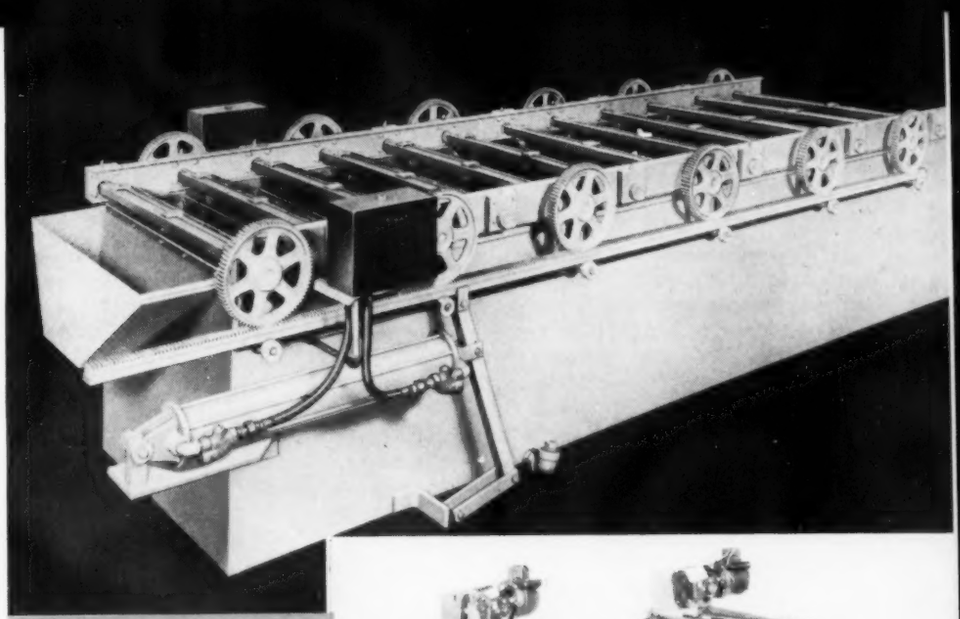


of salts operated at 210 F. The treating times are short, varying from 5 to 15 min. Non-copper-containing alloys will withstand 250 or more hours salt spray after treatment, and for copper-containing alloys and cast alloys, the corrosion resistance is somewhat less. The finish produced is usually a pleasing gray-green color.

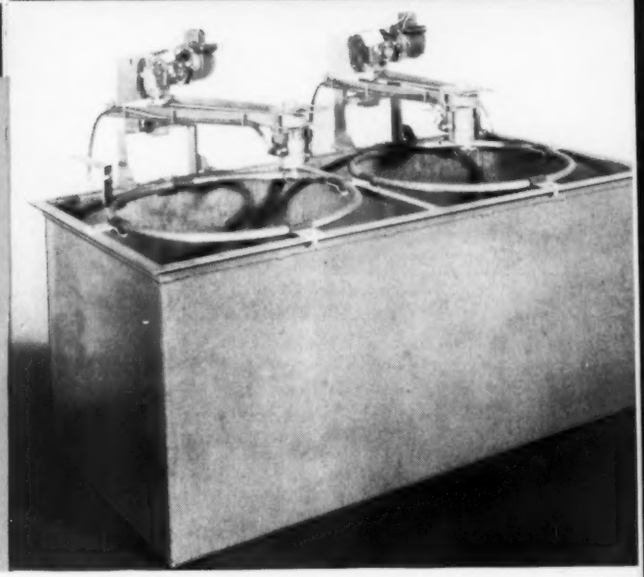
Copper Treatment Holds Paint

Another process developed during the war is used for direct chemical oxidation of copper and copper alloys to cupric oxide. The cupric oxide possesses high adhesion to the base copper alloys and also has high resistance to weather and salt-spray attack. The finish was used on a wide scale during the war for treating of army uniform equipment such as buckles, grommets, hooks and snaps, as well as radar coaxial tubes and other radio equipment subjected to severe corrosive atmospheres.

The finish is a good base for paints, lacquers and other organic finishes. It is easy to apply inasmuch as no current is used. The treating times run from 5 to 15 min. In postwar use, the process is being used for treating small copper and brass objects. A modification of this process enables the production of colors on copper and copper alloys, particularly brass. These oxide colors are more stable than sulphide colors.



Automatic transfer of parts from basket to basket is obtained in this dichromating unit by alternate pushes of racks on either side



Tubes and drawn cups can be plated inside and out, or disks on both sides, by making the piece rotate in the bath

Magnesium Now Anodized

One of the latest developments in metal finishing is a commercial method of anodizing magnesium alloys. This process is said to successfully overcome the following shortcomings of magnesium alloys:

1. Sufficiently protects the metal from attack by chlorides or corrosive environment.
2. Leaves a slightly acid surface for the proper adherence of primers or paint coating.
3. Shields the soft metal against wear and abrasion.
4. Reduces the high cathodic properties of the metal.
5. Insulates the metal against galvanic corrosion attack when assembled with dissimilar metals.

Various attempts had been made to anodize magnesium successfully on a commercial basis. It remained for an aircraft manufacturer to perfect a method and this method is now promoted by a supplier of plating materials and equipment. The process is electrolytic in character and produces a magnesium - oxide - silicate film, which is a pale green when applied with a direct current, or gray if applied with an alternating current. In either case, the films can be dyed with selective organic dyes. However, the d.c. process is preferred in developing the most desirable underlay for dyes. Shades of color may be developed from those of deep shades to light pastel shades by merely changing the length of time that the part is allowed to remain in the dye solution. The a.c. method is quite suitable for thin gage wrought and sheet alloy where the highest corrosion protection is desired.

Under normal conditions, magnesium parts can be anodized in 30 min. There is no important build-up of dimensions of machined surfaces; the film thickness normally does not exceed 0.0008 in. with the d.c. finish and 0.0004 with the a.c. finish. The a.c. finish penetrates into the metal, while the d.c. finish offers a build-up of approximately one-half of the film thickness. The finishes are both harder than the metal itself, and are quite resistant to abrasion and should not fail when subjected to a 90° bend when formed at minimum radii as specified for the gage and alloys, at room temperature. A film thickness of only 0.0002 in. possesses sufficient dielectric strength to withstand 110-volt current.

If the product is to be used for interior purposes, the natural anodized finish or a dyed anodic finish can be sufficiently protected with waxes, lacquers or drying oils. Articles exposed to the atmosphere may be given one dip coat plus one spray coat of zinc-chromate primer, followed by one coat of aluminized lacquer. Net cost of processing magnesium alloys by the anodic treatment is no greater, it is said, than when non-electric finishes are applied.

Plating Returns to Favor

With return to peacetime conditions, the emphasis in electroplating has swung back to the processes well developed before the war for decorative, protective and utilitarian purposes—namely, nickel, bright-nickel, chromium and cadmium plating processes. But during the war there were developments and improvements in these and other plating processes which will undoubtedly have many important applications. Details of sev-

eral of these developments are as follows:

When manufacturers obtain price advances that warrant product improvements, there is a likelihood that silver-plated bearings will be used in compressors and pumps. Such bearings made an outstanding record in aircraft engines. By good filtration and agitation of the warm plating solution, plus rotation of the bearings to obtain an even deposit, it was found possible to cut silver plating time to one-third the period used at the beginning of the war. The silver plate was usually bonded to the steel backing by a nickel or copper strike and then two silver strikes. After plating silver to 0.05 in. thickness on aircraft bearings, annealing at 1000 F. and inspection, the silver was machined to 0.015-0.020 in. thickness and plated with lead and indium. The 0.0005- to 0.001-in. deposit of lead served to embed dust or fine particles in the engine oil and the indium was diffused into the lead to increase its corrosion resistance.

Bright-Alloy Plating Arrives

For radar applications it was desirable to find a plated coating that would be less expensive than heavy gold coatings, that would give greater protective value on brass and yet would have high tarnish resistance. This need was met with a bright-alloy plating process producing deposits containing 55% copper, 30% zinc and 15% tin. This deposit is silvery in appearance, is bright as it comes from the plating bath and can be soldered with a non-corrosive flux more readily than any other plated coating. The deposit is relatively low in cost, is adaptable to precision plating, has good reflectivity and possesses unusual hardness—Rockwell 50 C. On non-ferrous metals such as copper and brass, the bright-alloy deposit gives excellent protection against corrosion. Over steel, the plate is not a rust-preventive agent in itself — a heavy copper deposit is required first upon steel articles. Postwar applications, because of the properties cited, have been worked out for such products as refrigerator evaporator units, camera parts, office equipment, jewelry, electrical and measuring instruments. In many instances, an underlay coat plating will not be necessary.

Three special solutions are available for the deposition of the cobalt-nickel electroplated coating. One solution produces deposits containing approximately 1% cobalt. The other two solutions produce a deposit containing 5 and 18% cobalt respectively. Special cobalt-nickel alloy anodes are used to maintain the proper ratio of cobalt to nickel in the electroplating bath. The solutions can be operated to produce full bright, lustrous deposits can be modified to produce semi-bright deposits which are capable of being buffed to a high luster.

The incorporation of cobalt with nickel gives deposits that are blue-white in color and increase brightness. The three processes need no organic brightening agents of high molecular weight which are difficult to control and which are, in many cases, removed by purification treatment. The cobalt-nickel solution can be continuously purified without removing essential constituents of the solution. This permits the continuous operation of such a bath 24 hours a day over long periods of heavy production.

The baths operate over a wide range of current density which enables the production of heavy deposits in a short plating time. The cobalt nickel deposits have less tendency to passivate than other bright nickel; thus, chromium plating over the nickel is facilitated.

Zinc Plating Has Future

Cadmium shortage during the war forced development of a high-speed plating process that produces pure, unalloyed zinc deposits, which are highly protective and satin bright to bright in color. The limitations of prewar zinc plating were overcome by using zinc-aluminum anodes, a bath containing zinc and sodium cyanides plus high current density and means to keep the solution clean. A modification of the bath permits zinc plating upon malleable and gray iron castings. If exposure of the product is such that white corrosion products are likely upon the zinc deposit, various film treatments may be applied—chromate, phosphate and blackening, or a special colorless lacquer may be used. Films can be colored green, yellow, olive drab, black. In one case, an electrical meter part is being zinc plated, bonderized and then painted—all at a cost less than cadmium plating. The prospect is that many concerns will now use zinc plating.

In Acknowledgment

The following companies and trade associations supplied information of value to the editors in compiling this section. Their cooperation is hereby acknowledged.

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Dow Chemical Company
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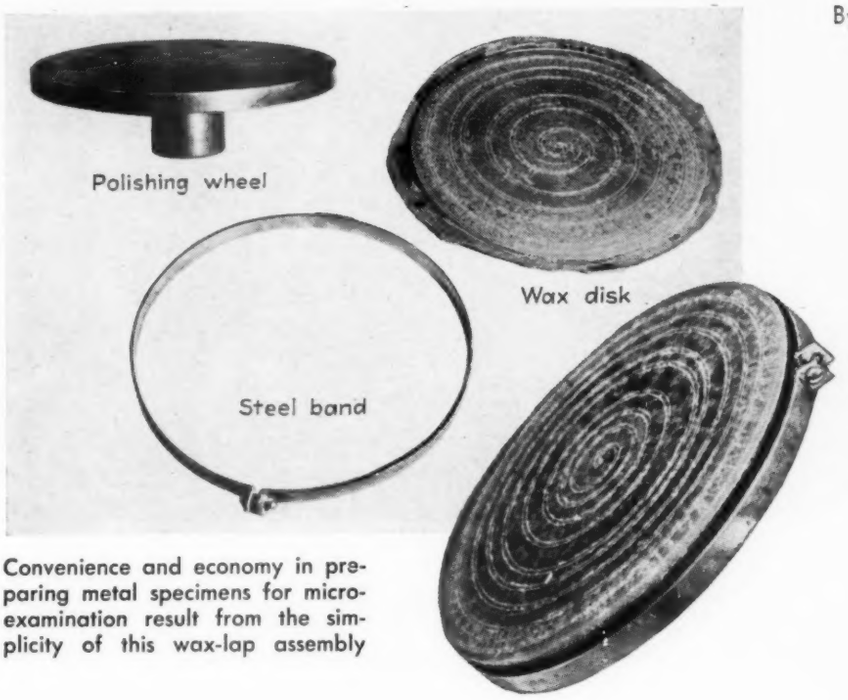
Hevi Duty Electric Company
E. F. Houghton & Company
International Nickel Company
Lepel High Frequency Laboratories
Lincoln Electric Company
Lindberg Engineering Company
Linde Air Products
Magnesium Association
Oakite Products, Inc.
Pennsylvania Salt Mfg. Company
Resistance Welders Manufacturers Association
Revere Copper & Brass, Inc.
Rheem Research Products, Inc.
Surface Combustion Company
Udylite Corporation
United States Steel Corporation
Westinghouse Electric Corporation

Removable Wax Disks Salvage Polishing Laps

By JOHN W. WEETON, METALLURGIST
THE WEATHEHEAD COMPANY



Convenience and economy in preparing metal specimens for micro-examination result from the simplicity of this wax-lap assembly

WAX-LAP POLISHING provides a final polish for visual micro-examination of steels and some of the harder non-ferrous metals. The process is advantageous in preserving inclusions and brittle edges and preventing comet-tail formations in graphitic cast irons. The lap is destroyed, however, in removing the wax lap from the metal polishing wheel to which it is conventionally fastened. A removable wax disk prevents this waste.

An 8-in. circular disk is cut from 3/16-in. masonite or linoleum and placed over a conventional 8-in. polishing wheel. A strong, coarse cloth about 12 in. in diameter covers this disk and hangs over the edge of the wheel. An adjustable steel band is placed over the cloth and around the O.D. of the wheel, extending above the cloth just enough to form the mold into which paraffin is poured. About ¾ lb. of paraffin, heated a few degrees above the melting point, is poured into the mold and allowed to cool overnight.

Excess wax is trimmed from the cloth and the steel band is slid down to bind the cloth edges securely to the wheel. The wax surface is machined with a flat edge at 250 r.p.m. until flat. Higher speeds may be used but they call for greater skill.

Spiral grooves, about ⅛ in. deep and ½ in. apart, are cut into the wax surface with a stylus. This may also be done by hand since the sole function of the grooves is to hold the abrasive. The surface of the lap is then charged with a suspension of levigated alumina, using one teaspoonful of alumina to 50 c.c. of water.

Steel specimens to be wax-lapped are first ground with Nos. 1/0, 2/0 and 3/0 emery papers. Specimens are moved back and forth on the lap, which rotates at 500 to 600 r.p.m. Scratches produced by the 3/0 emery are removed in a 90° direction by moving the specimen from the center to the periphery. After being polished for 15 sec. with a moderate pressure the specimen is revolved 180° and polished for 45 sec. with a light pressure.

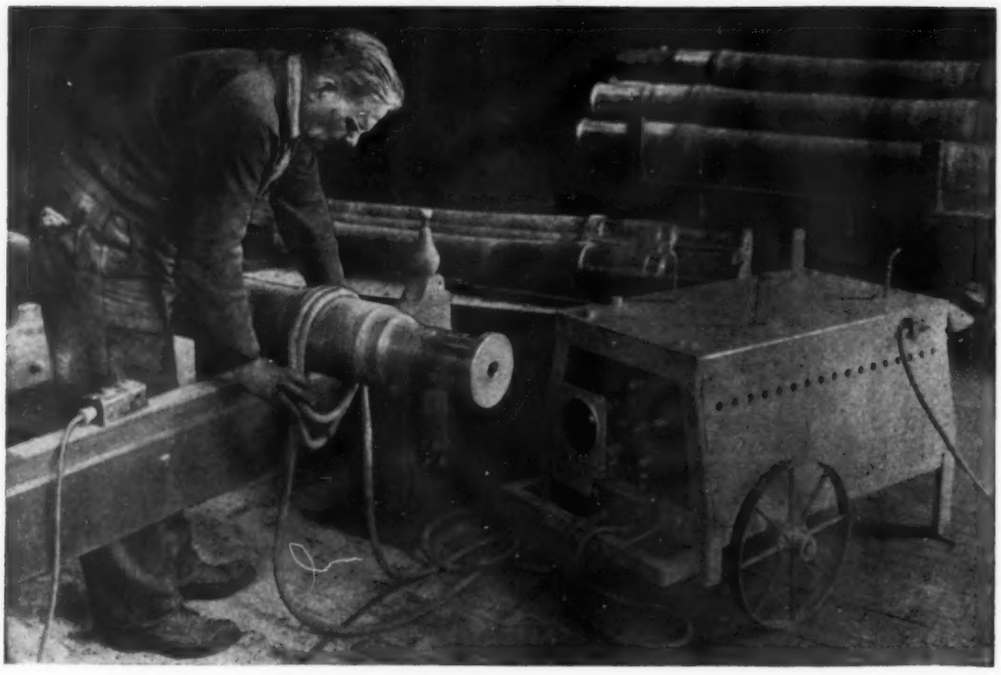
When the surface of the lap becomes loaded with abrasive it is scraped and the grooves cleaned with a stylus. Slight damage to the lap will not seriously affect the quality of the polish and any excessive indentations may be removed by re-machining. If the wax becomes too thin, additional paraffin may be remelted and cast over the old surface.

Interchangeable Threads Merit Further Study

IN CONSIDERING proposals for an Anglo-American form of thread to facilitate interchange of threaded parts it is interesting to review some of the suggestions made at the conferences which took place during World War I. One proposal was to adopt an angle of 57½°, a compromise between 55 and 60°. At first glance this has little appeal as one is apt to say, why adopt a mongrel angle instead of one or the other?

A study of the situation, however, indicates that this may have been a wiser suggestion than was realized at the time. Had it been adopted it would have saved us a lot of time and money during World War II. For, while it is an odd angle, so is the 47½° British Association thread, which they have no trouble in making.

With only a 2½° difference between a 57½° and the American or the Whitworth, all nuts of the new standard 57½° would go on either an American or Whitworth bolt in any class of fit in general use. It is in fact surprising to see how well a Whitworth bolt goes into an American nut at present. And for wrench fits, the metal on all but hardened bolts and nuts will flow enough to adapt the angles to each other. This subject merits further consideration. Now, if this disagreement is to be resolved.



The low-voltage cable is looped around an axle preparatory to inspection in the Mt. Clare shops

Magnetic-Particle Testing Prevents Railroad Failures

Flaws in forgings and castings are detected in advance through the use of a periodic inspection plan that avoids interruptions in service and delays in trains

BY LAWRENCE B. SAGLE, BALTIMORE & OHIO RAILROAD

REGARDLESS of the quality of the steel used in the manufacture of locomotive parts, there is always the possibility of failure in service. Such failures usually result from undetected flaws in a forging or casting. Neither the eye nor old methods of testing, such as the whitening and hammer test, are dependable. Small fractures often occur from the stress of service. These, if detected in time, may be arrested in their development by grinding them out. If not detected, they often develop rapidly in service until breakage occurs.

The problem, then, is to detect flaws, seams or cracks that may later develop to the point where breakage is inevitable. Locomotive failures are costly from a mechanical as well as an operating-department point of view. Therefore, in an effort to forestall or prevent such failures, the magnetic-particle method of inspection has come into wide use on our railroads. The Baltimore & Ohio, as part of its policy to use the latest and most up-to-date methods, is installing magnetic-particle testing machines at all the principal roundhouses and shops as rapidly as possible. Magnetic-particle testing is a vast improvement over older methods.

The Magnaflux method of inspection is a process whereby the object is magnetized by passing a high-amperage, low-voltage electric current through the metal, or through one or more turns of wire cable wrapped around it. The current sets up magnetic lines of force, or flux, in the metal. This causes a minute magnetic pole, or disturbance, to occur at the edge of any flaw, seam or crack, normally invisible to the eye, or even where flaws exist immediately below the surface. While the metal is magnetized, a ferromagnetic powder, sprinkled on the surface, will be attracted to the point of disturbance and clearly outline the track.

Such cracks or flaws, when located, if they do not penetrate too deeply, can be ground out with the use of proper grinding tools, thus reclaiming the part for safe and further use.

The Baltimore & Ohio installed its first Magnaflux outfit in November, 1942, at the Mt. Clare Shop, in Baltimore, and four more in the early months of 1943 at Cumberland, Glenwood (Pittsburgh), DuBois and Ivorydale (Cincinnati).

A summary of the first month of use of the machine at Mt. Clare shows that 288 locomotive parts were inspected, 30 of which were scrapped and 13 reclaimed. Of the 13 reclaimed, it was believed that fractures in five would not have been found by older methods of inspection, and would have, without a doubt, resulted in locomotive failures, damage to equipment and delay to trains.

During the first 60 days of use of Magnaflux at Mt. Clare, 631 locomotive parts were tested; 535, or 84.8%, were found to be sound; 63,

or 10%, were scrapped as unreclaimable; while, 33, or 5%, were reclaimed by grinding or machining out the small fractures until they could no longer be detected by Magnaflux.

A large percentage of piston rods inspected were found defective. Of 38 tested during the 60-day period, 15 were found defective and scrapped. Yet, by a careful test with the whitening and hammer test method, only two piston rods had been found defective during the previous year.

Of the 33 parts reclaimed, 13 were crossheads. There was no way of knowing how many crossheads, with small fractures, had formerly been placed in service and had possibly caused subsequent trouble.

The first machine at Glenwood Shops, Pittsburgh, was installed on March 15, 1943. During a two-day demonstration test, 28 specimens of material were inspected, of which 10 were found defective. Five of these were reclaimed and the balance scrapped.

On March 18, 1943, a machine was placed in service at Cumberland. In a three-day demonstration and training period, 26 parts were tested, of which ten were found defective, three scrapped and seven reclaimed. One of the curious examples proving the superiority of the new over the old test method was a piston rod. This rod had been thoroughly and carefully tested by the whitening method and a wedge driven into the keyway. There was no indication of a defect. However, when it was subjected to Magnaflux test, it showed flaws in two places. A number of cuts were then taken off the rod to a depth of 5/32 in. The crack still remained, so the rod was scrapped. As all careful tests with the whitening and hammer had failed to reveal defects, it is reasonable to suppose that this rod would have been again placed in service.

More Units Installed

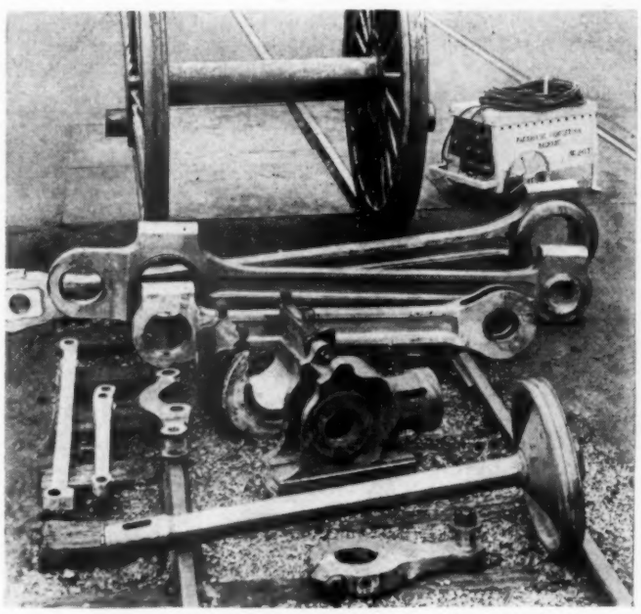
The first five machines soon demonstrated their superiority over the whitening and hammer test previously used, and, as a result, 15 additional machines were ordered in June, 1943. Then, in April, 1944, 22 additional machines were ordered, bringing the total on the B. & O. up to 42. There are now five at Mt. Clare; four at Cumberland; four at Glenwood; two at DuBois, two at Ivorydale; three at Washington, Ind.; two at Fairmont, W. Va.; and one each at Newark, Ohio; Lincoln St., Chicago; Riverside (Baltimore); Willard, Ohio; New Castle, Pa.; Grafton, W. Va.; Chillicothe, Ohio; Toledo; Stock Yards, (Cincinnati); Brunswick, Md.; East Side (Philadelphia); Connellsville, Pa.; Moorefield, Ind.; Benwood (Wheeling), W. Va.; Rikers (Rochester), N. Y.; 10th Street (Pittsburgh); Clifton, Staten Island; Lorain, Ohio; and E. Salamanca, N. Y.

As an example of the vigilance now being exercised through the use of these machines, beginning last May 17, all rods on high-speed passenger locomotives must be removed and given magnetic-particle inspections every 60 days—a veritable "stitch in time."

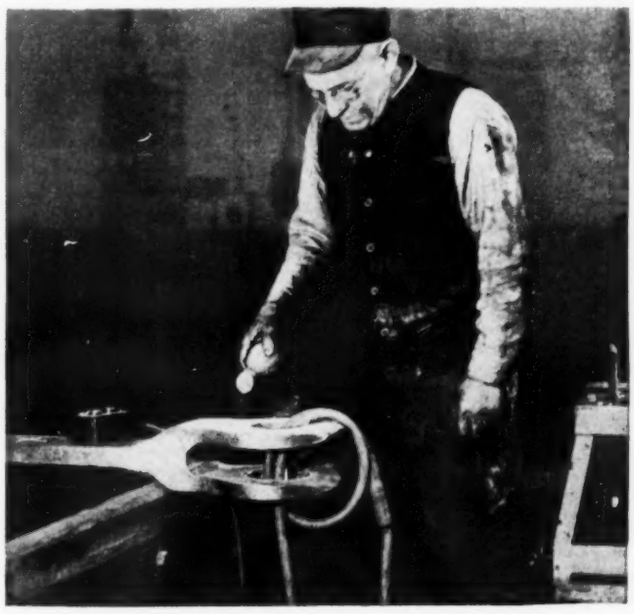
Admittedly, the magnetic-particle method is not perfect. It will not detect deep-seated flaws or internal fractures, and there are such things as false indications that must be recognized as such by the operator. Frequently, scratches, tool marks, sharp ridges or corners will give the same indication as cracks or flaws. However, such conditions are potential causes of failure, often developing, in service, into flaws, and should be ground out. Experience has shown, moreover, that defects located by Magnaflux in many cases are in the vicinity of the part where failures commonly occur. Therefore, these regions should be examined first. In the majority of cases, shallow cracks can be removed by dressing down the surface of the metal to the extent of eliminating the crack, provided it does not exceed the minimum tolerance.

The B. & O. uses the dry method exclusively, and parts regularly tested include main and side rods, valve-motion rods and parts, crankpins, crossheads and crosshead shoes, piston rods, engine-driving truck and trailer wheels, driving boxes, swing hangers, coupler yokes, equalizers, diesel-engine parts, and many more.

Not content with all of this, B. & O. engineers are studying other and newer methods of inspection (Magnaglow, for example) but until a better method is developed to a point where it is practical, the Magnaflux method will be used.



These locomotive parts are typical of those given magnetic-particle inspection



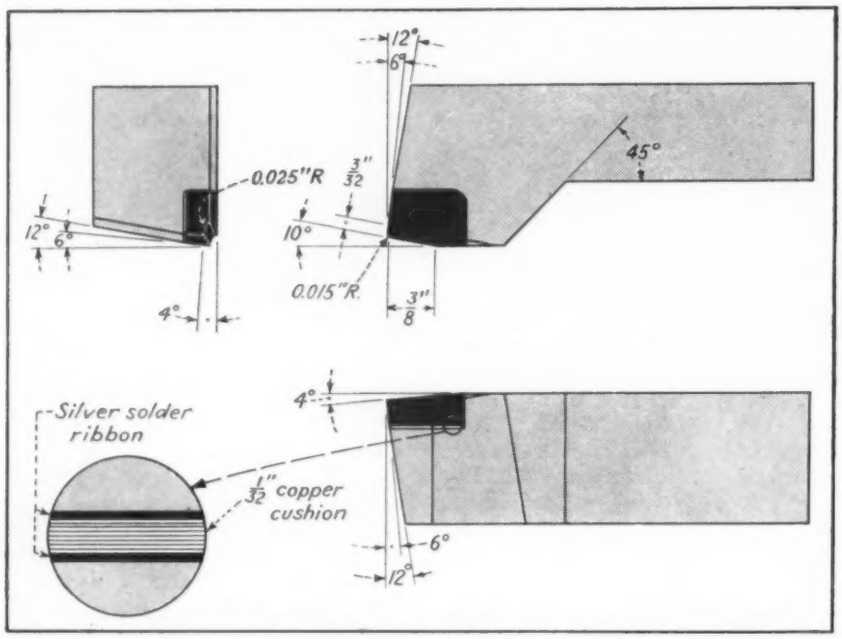
Dry ferromagnetic powder is sprinkled on a side rod; note the magnetizing cable

Cushioned Tips Extend Life Of Negative-Rake Turning Tools

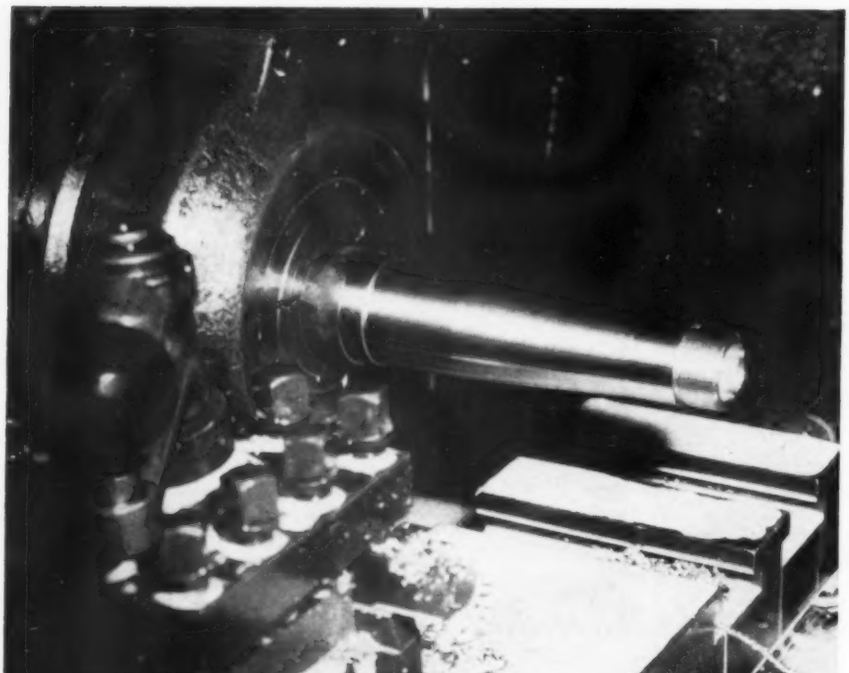
BY W. C. HOLLOWAY

BUICK-OLDSMOBILE-PONTIAC
ASSEMBLY DIVISION,
GENERAL MOTORS CORPORATION

When tools are removed from the machine, they are more likely to be dull than chipped, and losses in grinding are virtually nil



Most steel-turning jobs called for negative rake angles of 8 to 10°. All tool prints carried the circled instruction to show the cushion



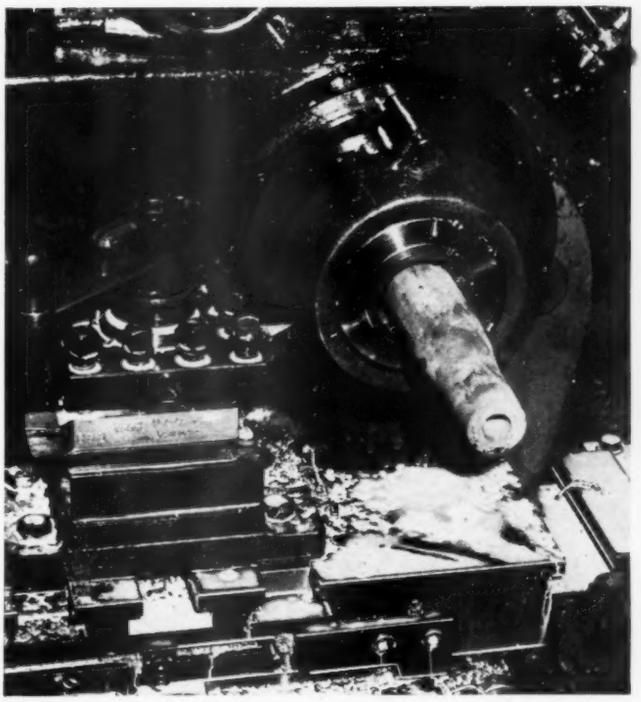
Cut completed in one pass. The bearing fits blend well with the taper and needed no grinding, because of the high-quality finish secured with a properly ground cutting edge on the negative-rake tool

IF THERE is a heavy copper cushion under the carbide tip, a negative-rake turning tool can be used to machine alloy-steel forgings at high speed, giving a finish that may avoid need for grinding. As developed at the former Eastern Aircraft Division, General Motors Corporation, Linden, N. J., standard practice required a 1/32-in. copper cushion between two layers of silver-solder ribbon. This practice virtually eliminated residual stresses in the tip as the result of brazing together two materials of such dissimilar coefficients of expansion as cemented carbide and steel. As a result, tool loss due to cracking of the tips during grinding dropped to virtually nothing, and tool life showed a marked increase.

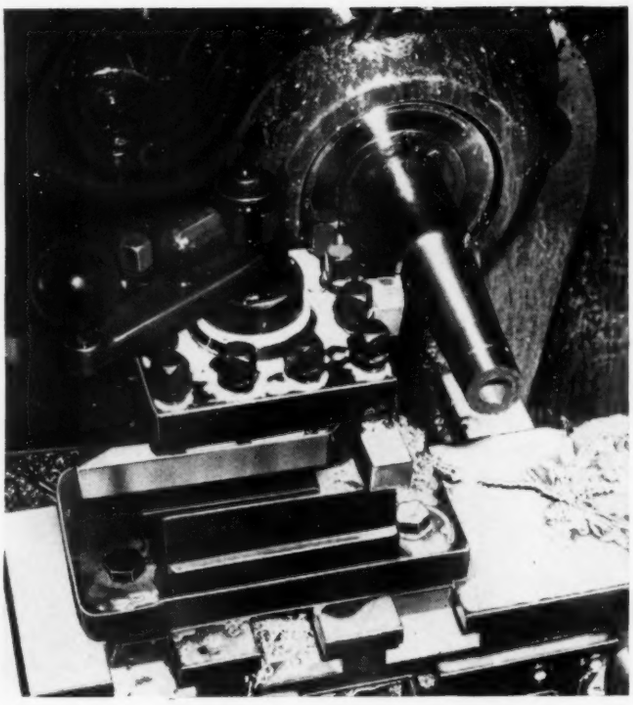
The benefits of cushion-tipped tools

DETAILS OF THE SETUP

Machine	No. 5 Warner & Swasey
Coolant	soluble oil
Material	chrome-moly (4140) forging
Hardness	23 Rockwell C
Tensile strength	110,000 psi.
Work speed	654 r.p.m.
Cutting speed	385 s.f.p.m.
Tool feed	0.012 in.
Depth of cut	5/32 in.
Work diameter	2½ in.
Work length	9 in.
Pieces per grind	147
Condition of tools	dull



Axle forging in lathe ready for turning. The point of the negative-rake tool was set on center, threw the chip ahead; there was no tendency of the free-cutting tool to crawl up



Tool is approximately halfway across the 9-in. cut. Excellent finish was obtained despite 5/32-in. cut in alloy material and cutting speed of 385 sfpm.

were particularly evident in the case of turret-lathe jobs. One of these involved turning a tapered axle. The tool was able to handle both bearing fits and the taper in one cut. By feeding in lightly at the same the speed, the end and shoulder were finished at the same time. In fact, the finish secured was practically equal to a ground finish. The tool was set on center, and despite the overhang of the piece from the chuck jaws, there was no tendency to crawl up. Before tool tips were cushioned, the number of pieces averaged 47 per grind and the tool was chipped after removal from the machine.

TO THE EDITOR

PERMANENT MACHINE TOOL EXHIBIT?

During the National Machine Tool Builders' Association meeting in Chicago, Tell Berna announced the decision of the members not to hold a show during 1946. He, furthermore, brought out clearly the fact that there is only one fairly suitable site for this show and that is in Cleveland, Ohio. As you well know, the Cleveland Auditorium is not too well suited for this purpose, as builders of larger equipment, particularly, are seriously handicapped not only by the matter of time but also the matter of facilities in erecting and demonstrating their larger tools. A premium is placed on the number of days before and after the show that it may be used by the builders for preparing their exhibit and tearing it down.

During the meeting of the horizontal boring machine group at the Edgewater Beach Hotel in Chicago, the writer brought up the possibility of a continuous exhibit of American machine tools in one of the larger centers, such as New York, Philadelphia, Pittsburgh, Buffalo, Cleveland, Chicago, Cincinnati, or even St. Louis.

Among the great number of DPC buildings erected during the emergency, the government might be willing to turn over one or more to the National Machine Tool Builders' Association, on an attractive basis, which could be maintained throughout the year, by those manufacturers who desire to do so, as a permanent exhibit and which would be operated from ten days to two weeks each year as a completely functioning exhibit by all builders. Therefore, builders would be responsible for space allocated to them and, by screening off the space temporarily, the exhibit could be changed at will without danger of premature announcement.

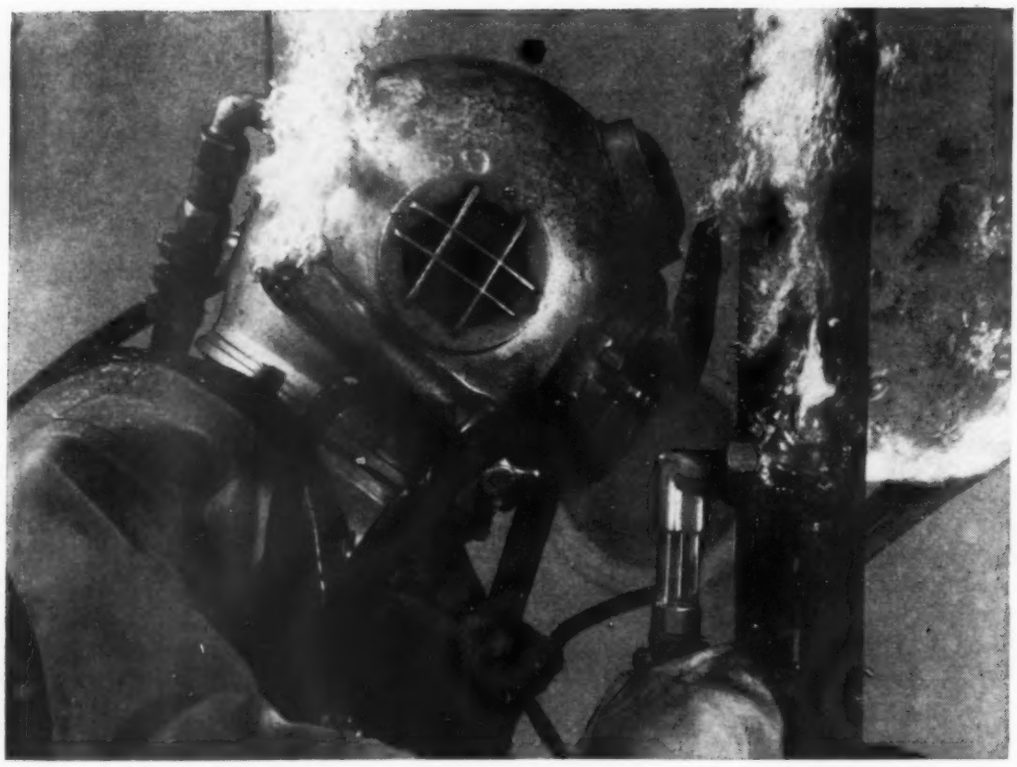
The National Machine Tool Builders' headquarters could be reallocated to make use of the office space, and offices could be assigned to the various exhibitors who might want to maintain engineers or servicemen in residence.

It would not be necessary to limit this activity to the machine-tool builders as it might be advisable, if sufficient space could be found, to include all associations and manufacturers in the heavy-goods industry and the small-tool manufacturers as well.

It is unnecessary to mention the effect such an exhibit would have on a visitor from a foreign country who would be able to visit one exhibit and view the products of the larger builders without the necessity of traveling over approximately half of this big country of ours and being subject to the discomforts and uncertainties of travel.

As you know, the Leipsig Fair was held for a great many years and drew visitors from all over the world. Certainly if the German machine-tool industry could carry on such a project, we should be the last ones to say that it would be impossible to carry it on here.

E. K. MORGAN,
General Sales Manager
GIDDINGS & LEWIS MACHINE TOOL CO.



A typical underwater cutting job in progress. Underwater gas cutting in principle is very much the same as open-air cutting, except for the restrictions imposed on the diver by the environment

FLAME-CUTTING STEEL UNDER WATER

BY DR. G. V. SLOTTMAN, APPLIED ENGINEERING DEPARTMENT, AIR REDUCTION SALES COMPANY

UNDERWATER flame cutting was first done in 1908 with a regular open-air torch, but early advocates soon recognized that the conventional torch was not practical for this kind of work. The flame encountered great resistance under water, which seriously interfered with flame stability and preheating effectiveness. Also, the flame could not be maintained when the cutting tip was directed upward. Directed downward, the flame would burn with a fair degree of stability if the torch was not shaken.

About 1912 it was discovered that a stable flame could be maintained by confining combustion in a closed chamber equipped with a special duct through which burned gases were expelled. Many other experiments were conducted in an effort to develop a cutting-tip arrangement which would allow the flame to burn effectively under water, but a lot of

Origins and wartime development of techniques for cutting with oxyacetylene, oxy-hydrogen and electric arc are presented in this 14th article of the series

water went over the dam before a torch was introduced which would perform efficiently and reliably under anything but predetermined test conditions. In fact, in the fall of 1925, when the "City of Rome" sank the U. S. Submarine S-51 in water 130 ft. deep, crew members were doomed because no torch was available which could cut through ship plate at that depth to make rescue possible. By the following spring a torch was developed which cut loose bolts and cable successfully—marking the first time underwater flame cutting had been accomplished at depths in excess of about 25 ft.

Recent developments have been due in no small part to the active interest taken by the U. S. Navy shortly before the second World War. Navy development and testing facilities in conjunction with private manufacturers was given increased impetus by the Pearl Harbor blow. The miracles of speed performed by naval and contracting salvagers in sweeping

away twisted masses of steel and recommissioning badly damaged ships in an unbelievably short time could never have been accomplished without modern underwater cutting and welding equipment. This great wealth of wartime experience, combined with other recent big salvage operations such as raising the *Normandie*, has resulted in the establishment of certain norms or recommended practices for efficient sub-marine cutting.

Underwater cutting in principle is very much the same as conventional torch-cutting, except for added limitations imposed by the environment on the operator — especially at great depth. The torch itself will function at any known depth. One of the most important considerations which must be taken into account is that these restrictions permit the diver to work only a short time on the bottom, particularly at lower depths, and therefore the correct technique and equipment becomes of utmost importance in terms of work accomplished per hour. It is well to review first the conditions which confront the diver-operator when he must work at any significant depth. Naturally the success and speed of cutting are directly dependent on these conditions. Diving apparel, great depth, fast current, low-temperature, poor visibilty and unstable footing are the most important factors which can make underwater cutting difficult and call for operators with greater stamina and ability than required for surface work.

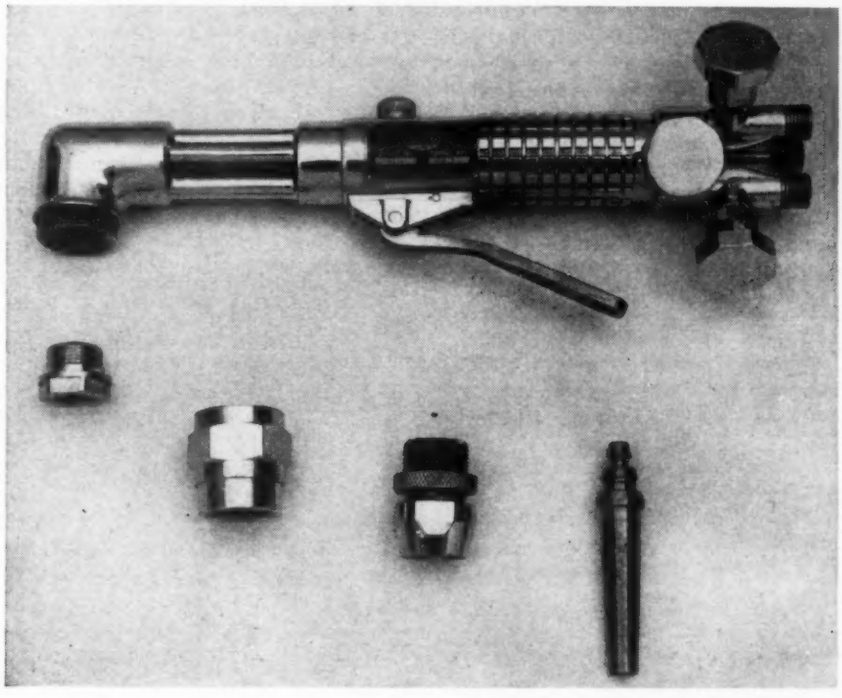
Efficiency Drops Off

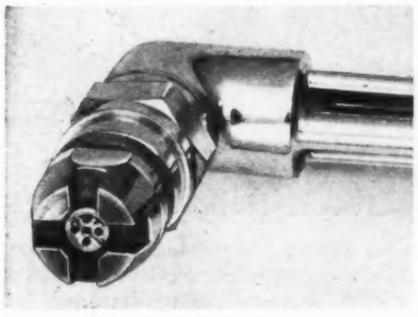
The limiting effect of a bulky 200-lb. diving suit is obvious enough when one considers the weighted shoes, control and air lines and the rest of the necessary paraphernalia. Near the surface, the operator works slightly slower than in the open air, but for longer periods than at great depth, as he is limited only by the encumbrance of this gear. However, the operator's efficiency decreases directly with his depth; at great depth the pressure imposes limitations on his physical ability. Descent to and return from great depths must be accomplished in stages.

Unstable footing and swift currents are also a great hindrance against which the operator must be continually on guard and which require that he keep a firm grasp on the work. These handicaps combined with poor visibility encountered at great depths or in muddy water and which sometimes cannot be penetrated by the most powerful lights, all tend to make underwater cutting slow and tedious.

Three methods of steel cutting—oxyacetylene, oxy-hydrogen and electric-arc—have proved well adapted to underwatre cutting. For oxyacetylene and oxy-hydrogen cutting, the same torch is used. The oxyacetylene flame is produced by the combustion of nearly equal volumes of acetylene and oxygen and gives the highest temperature of any fuel gas-oxygen mixture. This advantage combined with the fact that this flame is the easiest to regulate and control gives the oxyacetylene flame certain definite advantages over oxy-hydrogen. Actually a regular open-air oxyacetylene cutting torch can be used to a depth of 10 ft. with some degree of success. However, in most underwater cutting, the matter of pressure enters the picture, as water pressure increases about 0.433 psi. per foot of depth. Consequently, higher operating pressures are necessary to provide increase in flame preheat intensity necessary to offset the chilling effect of the surrounding water and to overcome the water pressure at whatever depth the torch is operated. Thus acetylene is generally unsafe to use at more than 15 lb. pressure or 25 ft. below the water surface, so hydrogen is employed at greater depths. The electric-arc cutting torch has come into use largely through wartime improvements and has one advantage over oxyacetylene and oxy-hydrogen cutting in that compressed air and fuel gas are not required.

Although the torch designed for oxyacetylene or oxy-hydrogen underwater cutting operates on the same principles as the conventional open-air torch, there are important differences in design. The head of the underwater torch is designed for a skirt or sleeve which surrounds the tip. A standard seat is provided in the head, accommodating regular straight tips and the tip nut. The outside diameter of the head is threaded to accommodate the skirt. Compressed air circulates between this skirt and the tip, providing the bubble necessary to force the water away





Underwater gas cutting torch with tip dismantled. Left to right above are the tip nut, skirt or sleeve, adjustable spacer with locknut, and cutting tip. The view at the left shows the assembly. Large control valves facilitate proper gas adjustment when heavy gloves are warn. Short torch body reduces kick-back when gases are released under pressure and makes torch easier to handle in cramped quarters

from the end of the tip and also the artificial atmosphere which assures proper combustion of the preheat flames. This skirt or sleeve does not form a part of the tip nut nor does it connect to any other part except the head. Its removal exposes the tip and tip nut, which are disposed in the same manner as in any standard torch. On the end of the sleeve assembly is an adjustable spacer guide and lock unit which is provided to regulate the clearance between the tip and the work. The tip itself is of standard mixing design, suitable for burning hydrogen.

Shorter Handle

The torch handle has been made considerably shorter than that used on open-air torches, to facilitate manipulation in confined areas and to reduce kick-back when the gases are released under pressure. In contrast to the ordinary torch, the regular tubes for fuel and oxygen are augmented by compressed-air tubes which run through the handle and transmit air to the head. This compressed air is discharged from holes in the head located to provide a uniform distribution of compressed air or artificial atmosphere within the chamber. A valve at the rear of the handle connects to the compressed-air hose. Wherever possible, standard torch parts, such as needle valves and the high-pressure oxygen valve, are used.

An operator who has qualified in the use of the cutting torch should have no great difficulty cutting underwater, provided he is also a qualified diver and is properly equipped for the job. The principal factor attendant to successful operation of the underwater cutting torch is the matter of sufficient gas pressures. As previously mentioned, it is necessary to have sufficient air pressure to overcome the head of water and the resistance of long compressed-air hose lines. The head of water pressure is 4.3 psi. for each 10 ft. of depth and the hose line will necessarily be long at greater depths, offering considerable resistance to flow, particularly if it is made up of a number of short lengths connected by couplings. It is necessary to adjust the compressed air at a pressure slightly less than the oxygen pressure, in order to force the water away from the tip to develop the atmosphere which will permit proper combustion in preheating flames.

The increased pressure will also affect the operating pressure for fuel gas and oxygen. As stated previously, acetylene fuel gas may not be used safely at pressures greater than 15 psi., therefore hydrogen must be used at depths greater than 25 ft. Theoretically, as long as combustion is too rapid for the quenching action of water to be effective, any fuel gas could be used. Oxy-propane underwater cutting has been attempted, but considerable difficulty is experienced because propane has a tendency to condense at low temperatures. The cutting oxygen requirement at the tip should not be greatly in excess of surface requirements and will vary with the tip used. At 100 ft. the water pressure is approximately 44 psi. Allowing 20 psi. for the hose and 50 psi. for the cutting oxygen, this would indicate a pressure of 115 psi. for the oxygen.

Table I shows working pressures recommended for underwater cutting. These are approximate figures, offered as a guide to insure a sufficient amount of air and gases at the torch for final adjustment under water. It must be remembered that cutting tables will be misleading if the fact is overlooked that regardless of the pressure at which the manifolds are set, the diver controls the actual operating pressures at the torch. This must be understood by the operator and the tender on the surface. Hydrogen, oxygen and compressed-air regulators should be adjusted by the tender on the top side and adjustment of the gases made to suit the depth at which the diver will work prior to sending down the torch. The handler on the surface should be cautioned against changing regulator pressure settings without informing the operator.

If the adjustable spacer shoe or distance guide is used to maintain a fixed distance between the torch and the work, it should be adjusted to allow a space of about 3/16 in. from the piece. On some torches, the size of the guide prohibits its use in cramped quarters, and the operator should make some practice cuts without its aid.

Underwater Lighter

It is preferable for the operator to light the torch after descending, when he is ready to start the job. Electric underwater lighters have been developed for this purpose. After making certain that all valves on the torch are closed and the switch lighter is turned off, the operator descends. In the event that a lighter is not available, the torch may be lit before descent and adjusted to sea-level pressure. As the diver descends, he will have to increase the pressures periodically to compensate for the increased water pressure. The torch is usually adjusted on the surface for a depth of 30 ft.

When the operator is ready to start,

Operator lights torch on the bottom with an electric underwater lighter when he is ready to start. The torch may be lit above water, but must be adjusted periodically to compensate for increased pressure during descent

he first opens the air valve sufficiently to produce a bubble about 3 in. long when the torch is held vertical with the tip horizontal. After he notes valve position, he closes it and repeats the procedure with the hydrogen valve. The oxygen preheating valve is opened only enough to obtain a bubble about 2½ in. long, then is closed after its position has been noted. This allows a slight excess of hydrogen which must be maintained over the amount required for perfect combustion to prevent the torch from backfiring.

The compressed-air and hydrogen valves are then opened to their predetermined positions and ignited with the electric lighter, after which the lighter resistance-coil switch is turned off to prevent the igniter from being eaten up by electrolytic currents. Ignition of the gases is accompanied by a slight explosive sound. The oxygen is turned on to its predetermined setting and here the operator must observe the flame carefully to make sure it is not burning within the tip. When this happens, the hydrogen must be turned off first to prevent the tip from burning out, then the other valves are closed immediately. Improper adjustment is soon evident, as the flame is not clear, burns inside the tip, and emits a stream of small bubbles. Proper adjustment is readily recognized as the flame burns clearly and the torch head and tip remain cool. Excessive heating of these parts is a danger signal, especially if it occurs immediately after lighting, and indicates that the flame should be shut off at once to check the gas adjustment.

Flame Adjustment

After the preheat flame is burning satisfactorily, the cutting flame must be adjusted and checked. This is best accomplished by holding a test bar near the tip while the hydrogen and oxygen preheating valves are adjusted until the test bar shows a white heat from the flame. Next, the high-pressure oxygen trigger is pulled and a hole will be burned through the test bar if the flame is adjusted properly. With torch controls properly adjusted, the operator is ready to start. In connection with this, it should be pointed out that an improperly adjusted flame will not cut steel any better under water than in the open air. Also, preheating under water will be somewhat slower than in open air, but the actual cutting action is generally faster.

After each underwater operation, the torch head should be dismantled, any sediment removed, and strainers and valves checked to make certain they are thoroughly clean. To prevent torch strainers and valves from becoming clogged with soapstone deposits, hoses should be subjected to 200-lb. pressure before use to free hardened deposits by expansion. The soapstone may then be removed with a mechanical cleaner such as a brush. All parts of the torch assembly should be carefully dried after submersion.

Fuel-gas consumption is four to six times greater under water than in air. In air, preheating time is proportional to thickness of the steel, whereas, under water sheet steel 1/16 in. thick requires about the same preheat as steel plate 1½ in. thick as the heat imparted to the light material is quickly dissipated while the mass of heavy material absorbs and holds heat under water. The cutting-oxygen requirement is also greater, although torch manipulation is the same. Holes are more easily cut under water because of the cooling effect of water around the tip. The speed of underwater cutting depends largely on visibility and other working conditions previously described.

At the present time, the underwater torch is not practical when cast iron, stainless steels or other non-ferrous metals must be severed. For straight cutting on medium-thickness plate, oxygen consumtion averages about four times that required for open-air cutting. However, difficult cutting, particularly at greater depths, may require greatly increased quantities of gas. To figure the time element for an underwater cutting operation it is well to estimate that the time required under best operating conditions will be about five times that required to do the same kind of a job in open air. Cutting has been accomplished successfully in 130 ft. of water on steel up to 6 in. thick. In conclusion, it is important to remember that all safety rules applying to conventional oxyacetylene cutting also apply to underwater cutting.

No discussion of underwater cutting would be complete without including the oxy-electric cutting method introduced about 1915, the design of which was influenced by the Navy during the past war. This torch does not depend on fuel gas for preheat so fewer gas lines and pressure adjustments are required. A hollow carbon-steel electrode is employed through which the cutting oxygen is directed to make the cut as the arc is struck. In other words, the hollow electrode causes the arc necessary for preheating and also passes the oxygen required for cutting. While some hazard might be expected using a high-current arc in saline water which is conductive of electricity, no difficulty has been reported. Most electrode holders are equipped with a cut-out switch which permits the diver to deenergize the electrode holder and attach it to his belt without fear of being shocked. However, the operator is entirely dependent on the attendant above to shut off the current. Also, there is some danger of striking an arc on a metal part of the operator's suit, such as the helmet, while manipulating a torch of this type.

The final installment will compare other gases with acetylene in cutting.

TABLE I—UNDERWATER CUTTING PRESSURE

Depth, Ft.	Water Pressure, psi.	Length of Hose, Ft.	Compressed Air, psi.	Hydrogen, psi.	Oxygen, psi.
10	4.3	100	60	60	80
20	8.6	100	65	65	85
30	12.9	100	70	70	90
40	17.3	150	80	80	100
50	21.6	150	85	85	105
60	25.9	200	90	90	110
70	30.3	200	100	100	115
80	34.6	250	105	105	120
90	38.9	250	110	110	125
100	43.3	300	115	115	135
125	54.1	300	125	125	145
150	64.9	350	140	140	160
175	75.7	400	155	155	175
200	86.6	450	170	170	190
225	97.4	450	185	185	200

TALKING SHOP

Sonic Tachometer

ALWAYS FASCINATING, because we know so little about it, is the field of sonics, or sound effects. A recent AM article discussed sound as an aid to blind inspectors who check parts. It was at Yale, as we recall, that some small-motor rotors had to be rotation-tested to destruction. Speeds were too high to measure, until some smart fiddle player suggested each rotor carry a slight projection. As speed increased, this projection made a sound of rising pitch. This was matched by the fiddler. When the rotor blew up, the fiddler identified the pitch of the note he was playing. This gave its cycles per second, or the rotor speed in revolutions per second.

Sound Effect

ANOTHER APPLICATION of sound is in tension-testing models of complex structures. The member under test is replaced by a length of piano wire. Another length of wire is stretched over knife edges spaced at the same distance as the member is long. It is tuned to the pitch of the test wire, then the structure is loaded. The other wire is loaded to the new and higher pitch. A simple calculation then gives loading on the full-size member.

Surplus Age

WE COULDN'T quite believe the report that the Chinese were to come here for training in a surplus engine plant as mechanics—then to accompany some of our extera aircraft engines back to China. The engines would power China's rebirth. Rumor offered no solutions for the problem of costly and scarce fuel. Washington sources doubt the soundness of the idea, point out that more suitable and economical stationary power plants are being declared surplus. But China does want manufacturing rights for a uniflow steam engine.

Producers Dismantle

WE HEARD the other day about a plant that was cleared of government materials and equipment in record time by using regular production workers to do the job. Then the maintenance crews prepared the equipment for storage.

Just a Drop

INDUSTRIAL troubles are often just as difficult to diagnose as some of the cases a doctor is called upon to treat. An example was the high percentage of rejections experimented by a plastic molder. It seems that about one out of every five molded parts had blisters on it, while the remainder were entirely satisfactory.

A representative of the molding-materials supplier was called in, and fortunately he had a bald head. While watching a line of plastic preforms being fed to the molding press, he felt a drop of water strike his shiny dome. Looking closely he discovered that the intermittent drip from an overhead pipe struck exactly once out of every five preforms, and the moisture carried into the mold was just enough to cause blistering. Thus the mystery was solved.

Scattered Shop

WHILE SQUEEZING our corpulent way through the "Muskallunge," one of our newer submarines, we caught a coattail on the heart of the machine shop. It's a lathe, built in alongside a gangway between engine rooms. The familiar twin handles on the compound rest are replaced by a knurled disk, and other controls are flattened to avoid projections. Even so, the operator would have to climb on it to clear a passing crew member. But submariners are used to that—everything is tight in a pigboat. Vises on benches are scattered everywhere—the maintenance shop is strung along the production line that sent tin fish to sink Tojo.

Thinking

THINKING is a peculiar process, usually flavored by point of view. Here are a few examples:

Business (Money)
Engineering (Product)
Labor (Dues)
Government (Power)

TIPS for Top Shop Men

17 Realize that the other man may have problems too. Be a friend as well as a boss. It's none of your business what employees do outside working hours — unless it affects their work. Then it becomes very much your job to stop or correct anything that lowers morale.

18 Know general company policies. Expedite operations and improve relations with other departments and individuals by following policy where defined, and asking for definition when it isn't.

19 You are the "tool supervisor" for your own department. You alone can get proper tools for your men and can see that they are kept in top-notch working order. Insist that drills, cutters, etc. be kept sharp, that chisels be deburred, that handles be solid. You'll cut accidents and up the production curve.

20 Mind your own business—but be sure you realize that everybody working for you is your business. Don't be a snoop, but by the same token, don't be so superior you can't show an interest in things.

Practical Ideas

HAVE YOU A PRACTICAL IDEA? . . . If so, send it in. Your idea will help other men, in other shops, who have a problem similar to yours. We pay for acceptable contributions prepared exclusively for this publication

Ideas From Halfway Around the World

S. FRAMUREZ

A shop in Bombay, India has evolved several procedures for handling the everyday toolroom and design problems which should be of wide interest

Testing A Square

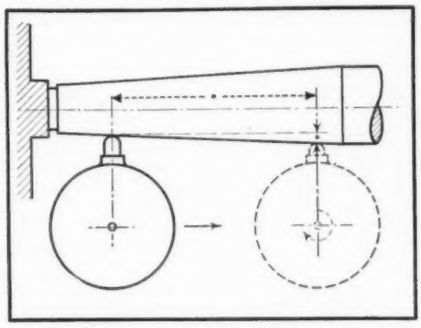
The conventional method for testing steel squares Fig. 1. briefly, consists of comparing the diagonals formed by four disks which touch both legs of the square and are mutually touching. The difference in the two readings (*AB–CD*) is double the amount of actual error. The limitations of this method are:

1. Appropriate sized (and very accurate) disks are required.
2. Only four points are tested; there is no provision for testing edge-straightness.
3. Only the inside of the square can be tested.
4. The method is a little awkward to perform because of the difficulty in obtaining accurate readings.
5. The angular conversion is somewhat complicated.

The suggested method, while it is just as precise, is free from all the foregoing limitations. In addition, it has the following advantages:

1. Two identical buttons of any size are used for all measurements, inside and out, on any size square.
2. A feeler gage is used instead of a micrometer, greatly simplifying taking of measurements.

The fixture consists merely of a T-slotted plate with a straightedge affixed at right angles to the slot. Squares are tested by placing them against the straightedge and against one fixed button. The other is then adjusted to touch also. (This can be done on either the inside or outside edge of the blade. The square is then flipped over and a feeler gage used to determine the error. This method gives a double error also. The long slot, of course, provides for moving the outer button to the maximum distance for the square being measured, thus to get the greatest possible error. In addition, in-between readings can be subsequently taken, and these points checked trigonometrically to determine straightness. The angle of error can be quickly calculated with the sine and tangent tables of very small angles, by simply measuring the distance between the buttons (as in sine bar work). With a 5-in. base line, the feeler measurement is the sine of the angle directly because the error is doubled but the base line only half.



Quick Taper Determination

An unknown taper is chucked true in a lathe and it is desired to check it. A dial indicator mounted on the tool slide will provide the necessary data without resort to complicated methods. (This system will work equally well in reverse, for testing indicators, providing a quick instrument check when an accurate taper-mandrel is available.) The axial and radial readings are noted somewhere near the narrow end of the taper. Then the carriage is advanced with the button being pushed in until a convenient even distance has elapsed. (Say, 2, 5 or 10 in.) The difference in the dial readings divided by the base line then gives the tangent of the angle. If taper is preferred in inches per foot, the above fraction is multiplied by 12. As a check, the

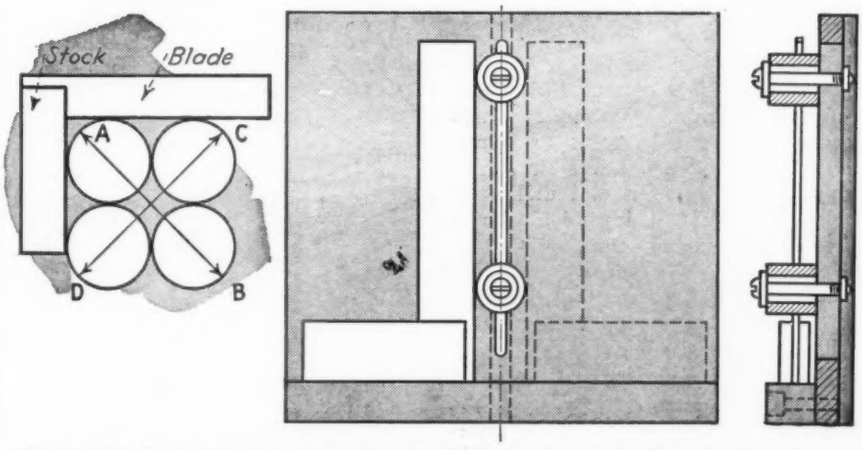
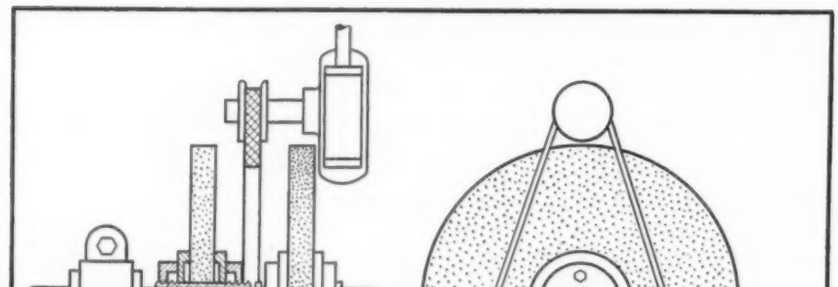


Fig. 1, left, shows the conventional method of checking a steel square by measuring diagonals. Fig. 2, right, is a plan of the new fixture



This coil spring grinder has two wheels, adjustable axially, so it can grind both ends of the spring simultaneously to the correct length. Continuous feed is provided with a slowly rotating drum

compound rest can be set accurately at right angles and its micrometer used for the longitudinal reading with the cross-feed micrometer reading the lateral difference. Here, after initial readings are taken (cross-feed, compound, and dial) and the compound has been advanced to the new position, the dial is returned to its initial reading with the cross-feed screw. Care must be taken, of course, to eliminate backlash wherever it may occur by making sure that all readings are taken with the screws traveling in the same direction. In a second reading, back the carriage past the number and then come back to it as originally.

Coil Springs Ground Continuously

In a recent issue, *Practical Ideas* featured a coil spring grinder. Here is an improvement on that suggestion. Coil springs were produced rapidly on a spring winder, but until this fixture was developed, finishing the end coils to correct length was a bottleneck.

This grinder employs two wheels on the same shaft. One of these is adjustable so correct spacing (for spring length) can be maintained. The feed drum in this case is an aluminum casting, with steel bushings which are a snug, sliding fit. Tapered guides center each spring as it approaches the two wheels. With the drum slowly rotated by belt and reduction gear, the operator merely displaces the completed springs as they leave the wheels with new ones.

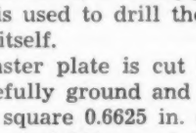
Square Plate and Nest Lays Out Precision Gage

CHARLIE WESLOW

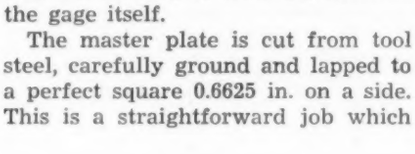
The problem was to make a gage which had four 0.0625-in. locating pins in its surface arranged in a very accurate square. This square was 0.600 in. on a side "plus or minus nothing." Long ago I was shown an easy way to lay out and drill four holes in a square using Jo blocks as the only measuring equipment. Nowadays there are expensive precision machines to do similar jobs, but this is one way to get the same results without them.

First a square master plate is made, and square notches the size of the drill cut in each corner. Next, a three-piece nest is made which accurately fits the master plate, completing the square holes in each corner. When assured that the master plate and nest are accurate, a drill jig is made, and this is used to drill the holes in the gage itself.

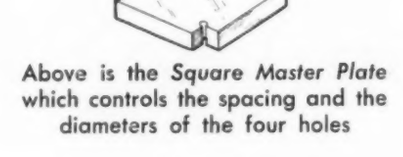
The master plate is cut from tool steel, carefully ground and lapped to a perfect square 0.6625 in. on a side. This is a straightforward job which



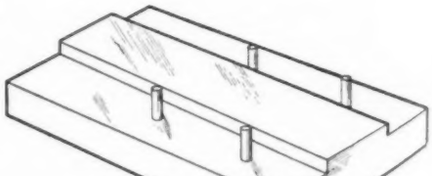
Above is the *Square Master Plate* which controls the spacing and the diameters of the four holes



The *Nest* consists of two U-shaped end pieces and a tongue, doweled and screwed together. The master plate fits into the nest, leaving a square hole at each corner



The *Jig* itself is drilled using the master plate and nest. The holes are lapped in final finish and the longitudinal slot fits the tongue on the nest and positions the holes, in turn, on the gage



Here is the finished Gage showing the four pins in place. All critical dimensions have tolerances of "plus or minus nothing." (These cuts are approximately full size)

can easily be checked and should present no difficulty. The four corner notches are 0.0625 in. square, with the inside of each corner relieved to assure clean sides. The only critical dimension on the two U-shaped nest pieces is the width of the U, which is easily checked with the master plate. A flat strip is then ground to the dimensions of the tongue on the finished gage. This is assembled to one of the nest pieces with two dowels and a machine screw with the inside edge of the notch accurately at right angles. The end of the tongue is then ground to make the distance between the inside edge of the nest piece just 0.719 in. (0.750-0.031) away. The other half of the nest is assembled in similar fashion using the master plate for positioning.

The jig is prepared by milling a slot to correspond with the tongue on the nest and on the gage. The master plate and nest is then placed in this slot and positioned longitudinally by the tongue assuring that the center of the first pair of holes will be 0.750 in. from the end. All parts were pack-hardened before final grinding so the square holes make just as good a drill jig as round ones, as far as accuracy is concerned. The jig blank is drilled, reamed and lapped to finished size, and then it is thoroughly checked. Now the real work is over; drilling the gage itself is merely a simplified repetition of making the jig.

It may seem that there are one too many steps here; the jig could be eliminated. However, it is justified by providing an additional check, and the safety factor of always having the master plate in case of any accidents.

Intermittent Leadscrew Makes Double-Helix Worm

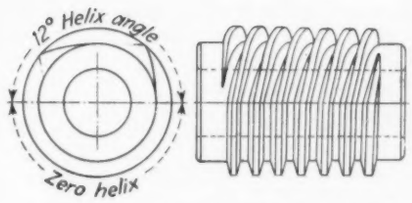
U. WHEATLY
New South Wales

The intermittent motion in a certain electric starting box is obtained with a special worm. This worm has zero helix angle for 180° and then a 12° helix for the remaining 180°. Here is a method for producing such a worm in a standard screw-cutting engine lathe with a minimum of modifications.

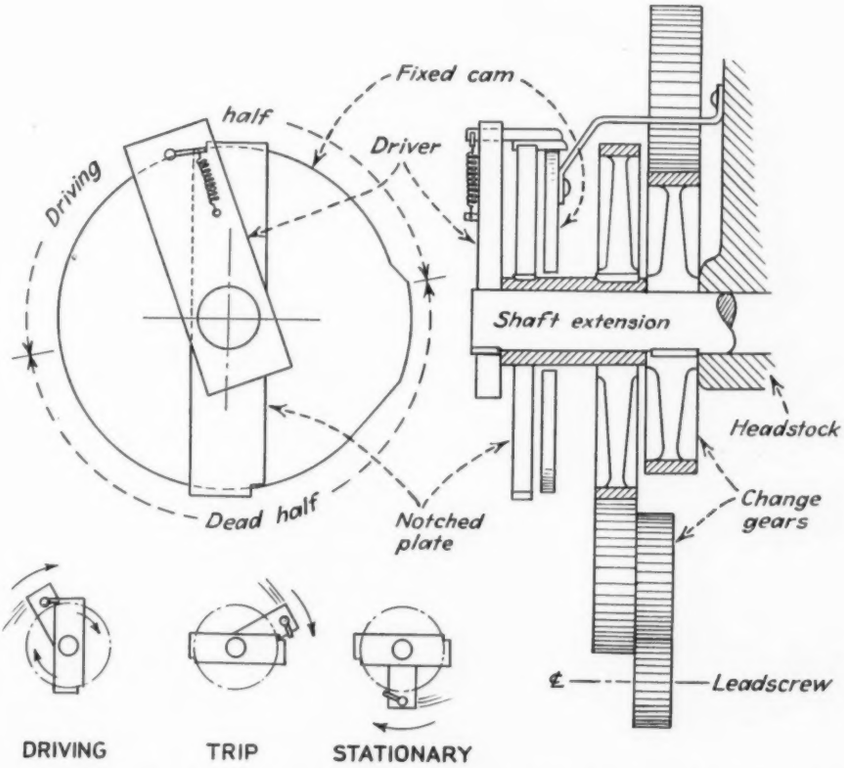
The leadscrew is caused to turn at uniform speed for half the spindle revolution and is stationary for the other half. This motion is derived from a double-armed crank (called notched plate) which is driven with a pawl. The pawl trips once every cycle, stopping the leadscrew until the pawl (moving at spindle speed) strikes the other end of the crank 180° away. Then this crank is driven, and in turn, drives the proper change gears and the leadscrew for half a revolution until the pawl trips again at the same place.

Construction is as follows: a stub shaft, carrying the pinion necessary to produce 1:1 ratio with the lathe spindle, is mounted at a convenient point in the change gear system. A sleeve is next fitted over the shaft, and to it are keyed the gear which drives the rest of the train, and the notched plate. At the end of the stub-shaft the spring-loaded pawl and its crank are fastened. Lastly, bracketed to the headstock is a disk cam which lifts the pawl at the proper time every revolution and guides it around for the next power stroke.

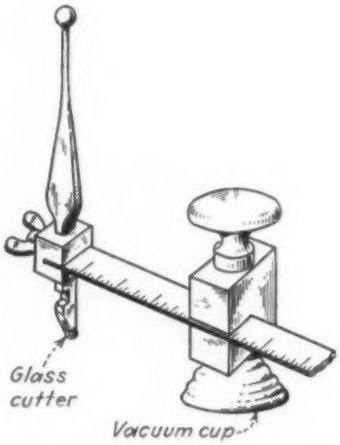
There may be ways to modify and improve this attachment, but the results have been entirely satisfactory, and the principle involved may suggest other applications. It should be emphasized that the transition is sudden and complete every half cycle and yet the part produced is perfectly smooth. The worm (or barrel cam) is actually a four-thread screw, with a thread beginning every 90°, except that each straight thread connects alternate helical threads which would have otherwise been the first and third for example, and thereby produces total motion for one revolution equivalent to a two-thread worm of 6° helix. If the illustration of the part is studied, it will be noted that both threads begin and end symmetrically, 90° apart in the upper half (as they have to) and the crests of the straight threads projected would intersect the midpoint of each adjacent helical thread.



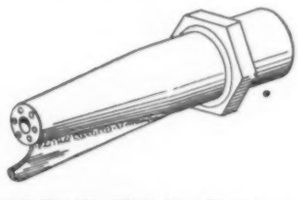
Part produced is a semi-four thread worm, actually a barrel cam



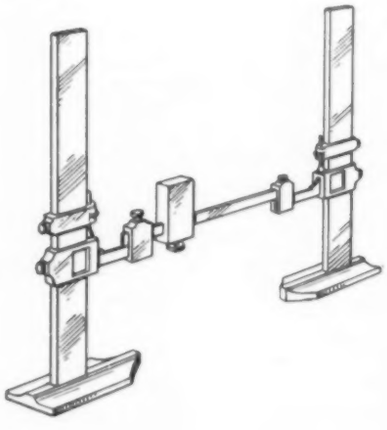
Intermittent leadscrew operation has been secured by installing this cam and lever arrangement on a shaft extension as part of the lathe change gears. Extension is driven at spindle speed and "notched plate" is caused to rotate 180° and dwell 180° by the driver, pawl and cam



Guide for Burning Tip—Brazing a copper guide on the end of a regular gas burning tip proved very successful. Similar to commercial "drag" tips, it is claimed that this method permits better preheat because it has more holes. *E. H. Bowser, Moore Dry Dock Company, Oakland.*

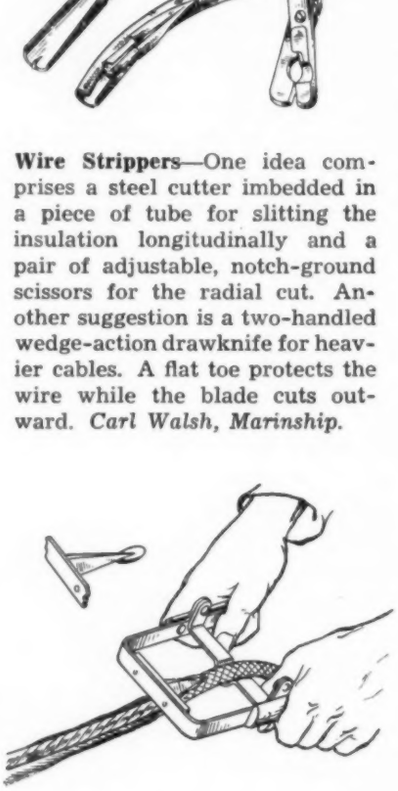


"Goal-Post" Height Gage — A piece of ground flat stock connects two vernier height gages thus becoming a vertical reference bar. This simple expedient assures rigidity over much larger distances and permits simultaneous measurements of various kinds. *Dale W. Steller, Goodyear Aircraft.*

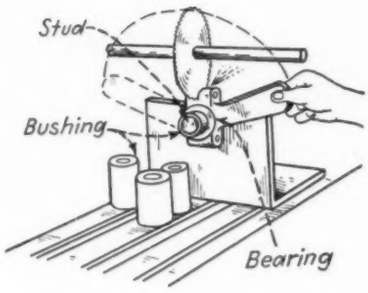


Vacuum Cup for Glass Cutting—A notched pivot block was attached to a rubber suction cup. The glass cutter, fastened to a radius arm, is then adjustable at the pivot. If accuracy is required, the center mark can be a circle the size of the suction cup. *Juel Darling, Kaiser Co. Yard No. 3, Richmond.*

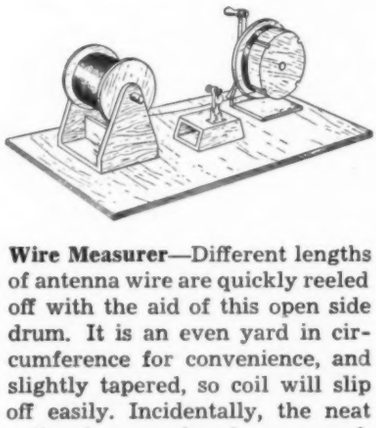
Wire Strippers—One idea comprises a steel cutter imbedded in a piece of tube for slitting the insulation longitudinally and a pair of adjustable, notch-ground scissors for the radial cut. Another suggestion is a two-handled wedge-action drawknife for heavier cables. A flat toe protects the wire while the blade cuts outward. *Carl Walsh, Marinship.*



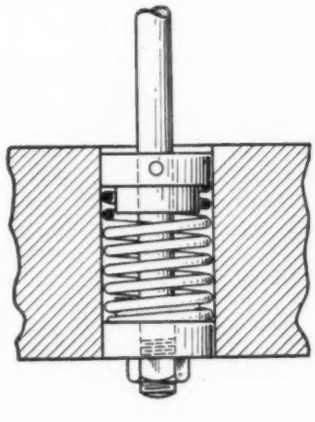
Quick-Acting Lock — This expanding spring clamp may prove effective when setscrews or other methods are impractical. Two collars, one of which is pinned on, serve to line the shaft in the hole and to hold the close-fitting coil spring. Tightening the nut at one end compresses the spring, thereby causing it to grip tightly in the hole. Axial and bending strength is high, but the device is not recommended for torsional holding. *L. Kasper.*



Bearing Splitter — Small split-bearings are quickly made with the aid of this stud and plate. Assorted bushings are provided to take different bearings, and marks are inscribed on the plate to line up the cutter and the work for the two cuts (one each side). Work requires no clamping: the thrust of the saw cut holds the piece against the plate and vertical feed takes care of the rest. *Irwin W. Shappell.*



Wire Measurer—Different lengths of antenna wire are quickly reeled off with the aid of this open side drum. It is an even yard in circumference for convenience, and slightly tapered, so coil will slip off easily. Incidentally, the neat coils thus produced are much easier to handle. *Paul R. Gandy, North American Aviation.*



Air Cylinders Clamp Long Channel Uniformly

RICHARD WESTON
Boeing Aircraft Company

The 15-ft. bomb rails for the *Superfortress* have to be straightened in a stretch press after extruding. Clamping is simultaneously accomplished with four pairs of sliding plates, each pair of which is actuated by two four-in. floating air cylinders. The supporting frame is built around a standard 8-in., 31-lb. H-beam with the web bored through at intervals for the eight cylinders.

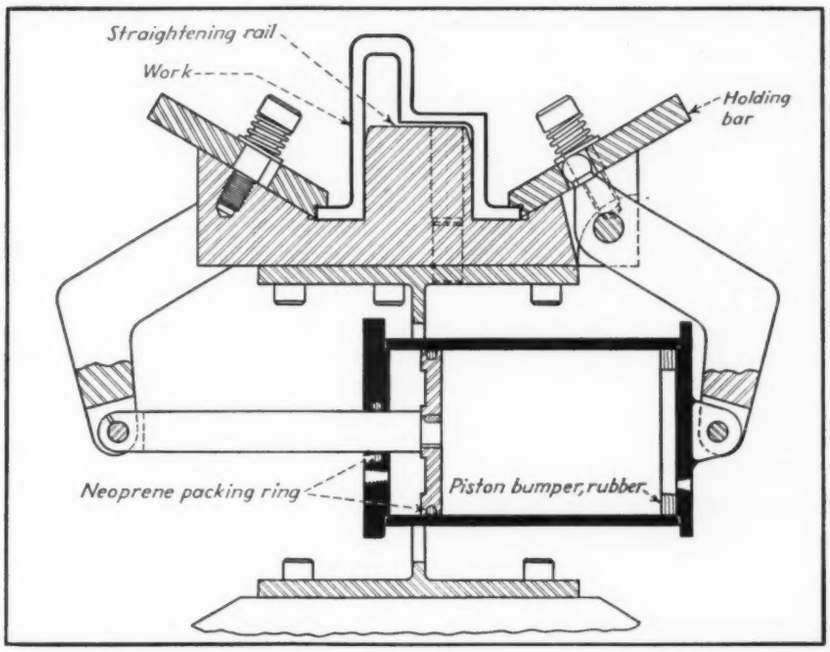
Each clamp is held to the inclined surface with four ¾-in. cap screws which pass through slots in the plates and carry coil springs to guide the plates and hold them down at the same time.

The rocker arms, pivoting on pins held in the inclined part of the long guide, are the sole support for the air cylinders. One rocker arm in each pair is pinned to the piston rod and the other is pinned to a clevis welded to the cylinder head. The opposite ends of the arms fit into slightly larger holes in the clamping plates.

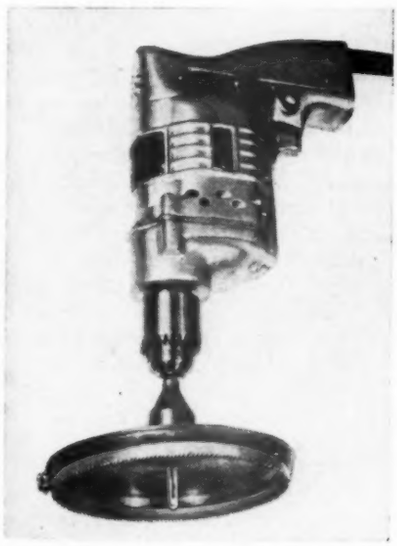
The long guide conforms to the inside of the channel preventing distortion, and the inclined surfaces of the guide support all the moving parts, as described.

The cylinders are built-up from seamless steel tubing, 4½ in. O.D., bored, ground and polished to 4.000 in., plus 0.001 in. and minus 0.000 in. The piston is made of mild steel plate, ½ in. thick and 3.998 in. in diameter and grooved for a neoprene seal ring. The rod is 1 in. in diameter. Piston and rod are guided by a ⅝-in. disk bolted to the low-pressure end. The cylinder head is also ⅝ in. thick, tapped for air connection and fitted with a clevis to take the rocker arm.

When the piece to be straightened is slipped over the guide, one air valve is opened admitting air to all eight cylinders and the plates close simultaneously, forcing the clamping plates down and in at the same time.



Sectional view of one of eight floating air cylinders and the linkage which clamps along extruded channel for the stretching operation



One-piece saw holder has concentric grooves for many diameters. A broken bandsaw blade is cut into several lengths, one for each circumference

Hole-Saw for Sheet Metal Utilizes Old Bandsaws

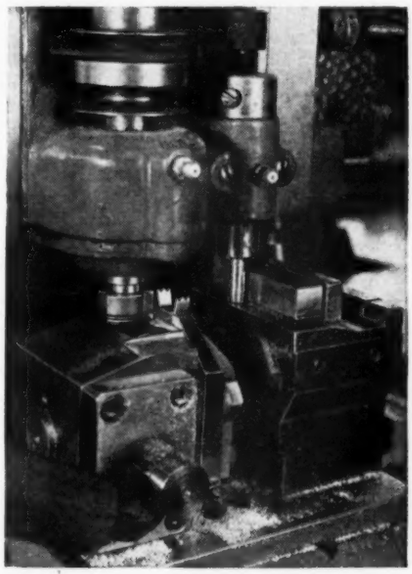
ELMER J. HAMMOND
Naval Air Station, San Diego

This quickly made tool utilizing old bandsaws is claimed to save $800 annually in cutting hand and access holes in TBF and FM airplanes. The arbor and pilot is one piece, and the saw-holding disk setscrewed to it. Photograph shows original model; improved version has a disk with several concentric grooves in its face to take various saw sizes for different diameter holes, and by using two saws, doughnuts can be cut in one operation. With the new model, 4 Allen setscrews grip the saw radially.

Fiber Clip Machined With Aid of Pilot Pin and Contour Block

In this setup a small fiber block is milled flat on one side and flanged on the other. This is accomplished at the same clamping with the same cutter by means of a pin bolted to the spindle bearing and a guide block on the machine table.

The work is clamped to fixed stops



Both sides of small fiber block are finished with different shapes by the same cutter, shifted vertically

with a quick-acting vise. In the position illustrated, the pin end is resting on the horizontal surface of the guide block and against the vertical surface. This permits the cutter to travel relative to the part in only one direction: laterally, producing the flange shown. When this is completed, the spindle is lifted clear and the pin brought down in the far groove against the far surfaces. Now the notched part of the cutter is below the work and a straight cut is taken on the other side of the piece. This arrangement is very fast and has completely avoided loss due to scrap.

Ball-Bearing Cleaning Machine Accommodates Assorted Sizes

ALBERT P. CRAWFORD
Navy Yard, Mare Island

The equipment consists of a built-up cabinet of transparent plastic sheet containing a slowly revolving disk. The bearings to be cleaned are placed on studs around the periphery of the disk, and as it rotates, the bearings pass under alternate jets of solvent and air.

The solvent is circulated by a vertical electric pump discharging to a header under the cover plate, and thence through the jet tubes to the bearings. The liquid drains through a chamois filter beneath the disk to a reservoir, keeping the pump suction operative at all times.

An air line is connected to a similar header and jets, and the excess air is removed through a flexible exhaust hose.

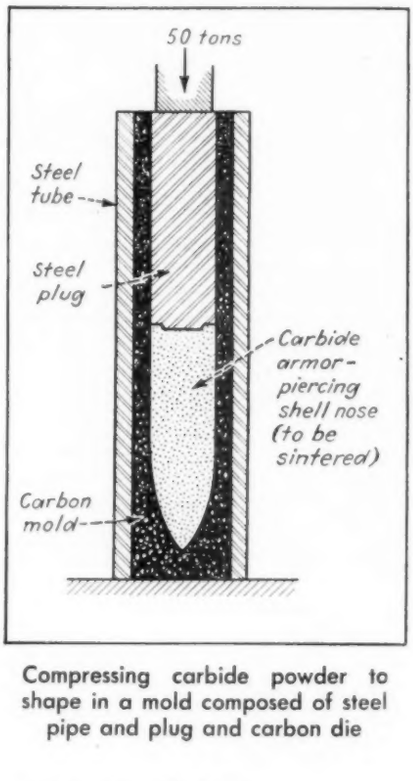
The vertical turntable spindle turns on bearings mounted inside a heavy supporting pipe, flanged at the top and bolted to the cover plate, and is driven by the motor at a very slow speed through a double-reduction worm gear set.

The inexpensively constructed unit is made versatile by using studs small enough to take miniature bearings, but through a range of adapter bushings, it is able to handle larger diameters as well.

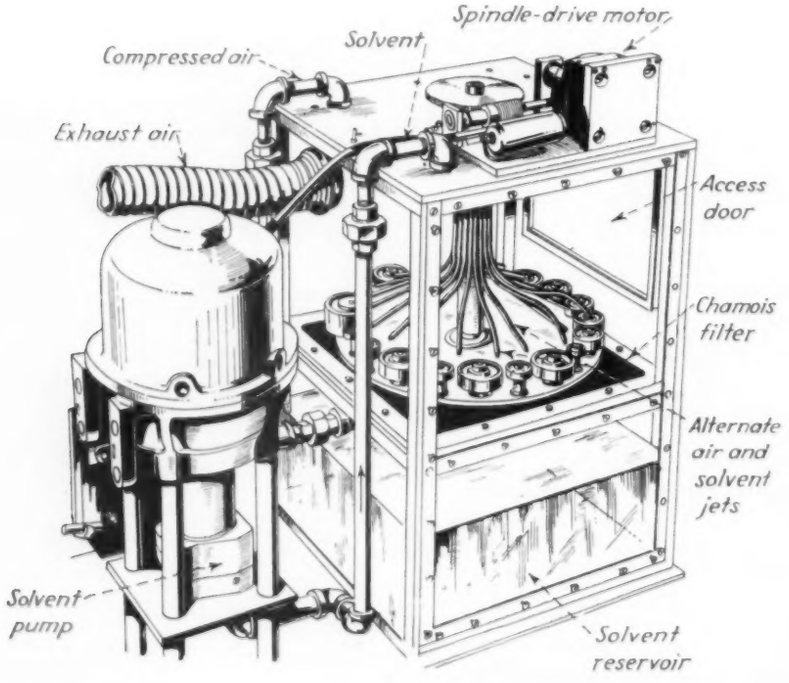
Access is through a door in one side, and the construction permits of complete dismantling for cleaning and adjusting.

As a test unit, this model proved so successful that several were built, and the savings annually have been estimated at over $27,000.

Since the jets strike the bearings at an angle, a turbine action gives them a spin automatically, exposing the entire surface of races and balls, and giving the solvent and air a chance to dislodge stubborn particles. Several repetitions of this cycle do a really thorough job of cleaning. *Suggestion submitted under the Navy Employees' Suggestion Program.*



Compressing carbide powder to shape in a mold composed of steel pipe and plug and carbon die



Ball-bearing cleaning machine sprays bearings alternately with solvent and air as they slowly rotate on a suspended disk

Dry Powder Molding Makes Carbide Parts

The production of sintered carbide cores for armor-piercing shells illustrates a simple solution to an interesting problem. This method produces a finished piece requiring no further treatment by pressure molding.

The mold or die is prepared by fill- a heavy-walled steel pipe with granulated carbon. This is compressed until it becomes solid. Then the center is bored and reamed with a forming tool to the finished shape. An accurately weighed amount of carbide powder is dumped in and a hardened steel plug fitted to the hole in the top. This plug is formed to the end shape of the carbide core and its length is such that it is flush when the mold is the right length.

The weighed amount of carbide powder was varied until the best value was found, at which the pressure to close the mold is about 50 tons.

After sintering the whole unit in an oven, the carbon, carbide and plug are pressed out and the carbon die is broken away.

Cold-Rolled Carbon Steel Strip—II

Edges of Cold-Rolled Strip

Ordinary Practice

No. 2 Edge is a natural mill edge carried through the cold rolling from the hot-rolled strip without additional processing.

No. 3 Edge is an approximately square edge produced by slitting only.

Standard Special Edges

No. 1 Edge is a rolled edge, either round or square as specified, supplied when a very uniform width is required and where the finish of the edge must be suitable for plating.

No. 4 Edge is a round edge produced by edge rolling from either hot-rolled or from split-edge material. This edge is furnished where an approximately round edge is desired and where finish of the edge is not important.

No. 5 Edge is approximately square and is produced by rolling or filing after slitting to remove burr only.

No. 6 Edge is a square edge produced generally by edge rolling the square-edge hot-rolled strip where the width tolerance and finish required are not as exacting as for No. 1 Edge.

THICKNESS TOLERANCES

Measured 3/8 in. in from edge of 1 in. or wider; and on narrower than 1 in. at any place on the strip

Thickness, Inch		Variation from Specified Thickness for Widths Given—Over or Under, inch							
Over	To and Incl.	Under 1 to 3/16 Incl. + & —	Under 3 to 1 Incl. + & —	3 to 6 Incl. + & —	Over 6 to 9 Incl. + & —	Over 9 to 12 Incl. + & —	Over 12 to 16 Incl. + & —	Over 16 to 20 Incl. + & —	Over 20 to 24 Incl. + & —
0.160	0.249	0.002	0.003	0.0035	0.0035	0.0035	0.0045	0.005	0.005
0.099	0.160	0.002	0.002	0.003	0 003	0.003	0.0035	0.0045	0.005
0.068	0.099	0.002	0.002	0.0025	0.003	0.003	0.0035	0.0035	0.0035
0.049	0.068	0.002	0.002	0.0025	0.0025	0.0025	0.003	0.0035	0.0035
0.039	0.049	0.002	0.002	0.0025	0.0025	0.0025	0.003	0.003	0.003
0.034	0.039	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
0.031	0.034	0.0015	0.0015	0.002	0.002	0.002	0.002	0.002	0.002
0.028	0.031	0.0015	0.0015	0.0015	0.002	0.002	0.002	0.002	0.002
0.025	0.028	0.001	0.0015	0.0015	0.002	0.002	0.002	0.002	0.002
0.019	0.025	0.001	0.001	0.0015	0.0015	0.0015	0.002	0.002	0.002
0.012	0.019	0.001	0.001	0.001	0.0015	0.0015	0.0015	0.0015	0.0015
0.011	0.012	0.001	0.001	0.001	0.001	0.0015	0.0015	0.0015	0.0015
0.009	0.011	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
0.005	0.009	0.00075	0.00075	0.00075	0.001	0.001	0.001	0.001	0.001
—	0.005	0.0005	0.0005	0.0005	—	—	—	—	—

For thicknesses 0.250 in. and over, the tolerances are subject to agreement.

WIDTH TOLERANCES

Standard Special Edges

Edge No.	Widths, In.	Thickness, In.	Tolerances in Widths, Either Way, In.
1	3/32 and narrower	to 1/16	0.005
1	Wider than 3/32 to 3/4	to 3/32	0.005
1	Wider than 3/4 to 5	to 1/8	0.005
4	1/2 and narrower	to 3/16	0.010
4	Wider than 1/2 to 1	3/16 to 0.025	0.015
4	Wider than 1 to 2	1/4 to 0.025	0.025
4	Wider than 2 to 4	1/4 to 0.035	3/64
4	Wider than 4 to 6	1/4 to 0.047	3/64
5	3/32 and narrower	to 1/16	0.005
5	Wider than 3/32 to 3/4	to 3/32	0.005
5	Wider than 3/4 to 5	to 1/8	0.005
5	Wider than 5 to 9	1/8 to 0.008	0.010
5	Wider than 9 to 20	0.105 to 0.015	0.010
5	Wider than 20 to 24	0.080 to 0.023	0.015
6	1/2 and narrower	to 3/16	0.010
6	Wider than 1/2 to 15/16	3/16 to 0.025	1/64
6	Wider than 15/16 to 2	1/4 to 0.025	1/32
6	Wider than 2 to 6	1/4 to 0.025	3/64

No. 2 Mill Edge

Range in Specified Width, In.		Over, In.	Under, In.
Over	Up to and Including		
—	2	1/32	1/32
2	5	3/64	3/64
5	10	5/64	5/64
10	15	3/32	3/32
15	20	1/8	1/8
20	24	5/32	5/32

No. 3 Slit Edge

Ordered Thickness, in.		Width Range, in.									
From	To and Incl.	Under 1/2 to 3/16 Incl. + & —	Under 1 to 1/2 Incl. + & —	Under 1 1/2 to 1 Incl. + & —	Under 3 to 1 1/2 Incl. + & —	3 to 6 Incl. + & —	Over 6 to 9 Incl. + & —	Over 9 to 12 Incl. + & —	Over 12 to 16 Incl. + & —	Over 16 to 20 Incl. + & —	20 to 24 Incl. + & —
0.249	0.161	—	0.016	0.016	0.016	0.016	0.020	0.020	0.031	0.031	0.031
0.160	0.100	0.010	0.010	0.010	0.010	0.010	0.016	0.016	0.020	0.020	0.020
0.099	0.069	0.008	0.008	0.008	0.008	0.008	0.010	0.010	0.016	0.016	0.020
0.068	0.017	0.005	0.005	0.005	0.005	0.005	0.005	0.010	0.016	0.016	0.020
0.016 and under		0.005	0.005	0.005	0.005	0.005	0.005	0.010	0.016	0.016	0.020

PRECISION THAT LASTS

WEBBER

Heavy Duty

GAGE BLOCKS

● The reason that the life expectancy is longer and original accuracy maintained for such long periods is due to the inherent quality built into Webber Gage Blocks.

This comes from selection of the correct steel—proper heat treatment—skillful finishing—and "know how" gained from years of painstaking experience in the exclusive manufacture of Webber Gage Blocks.

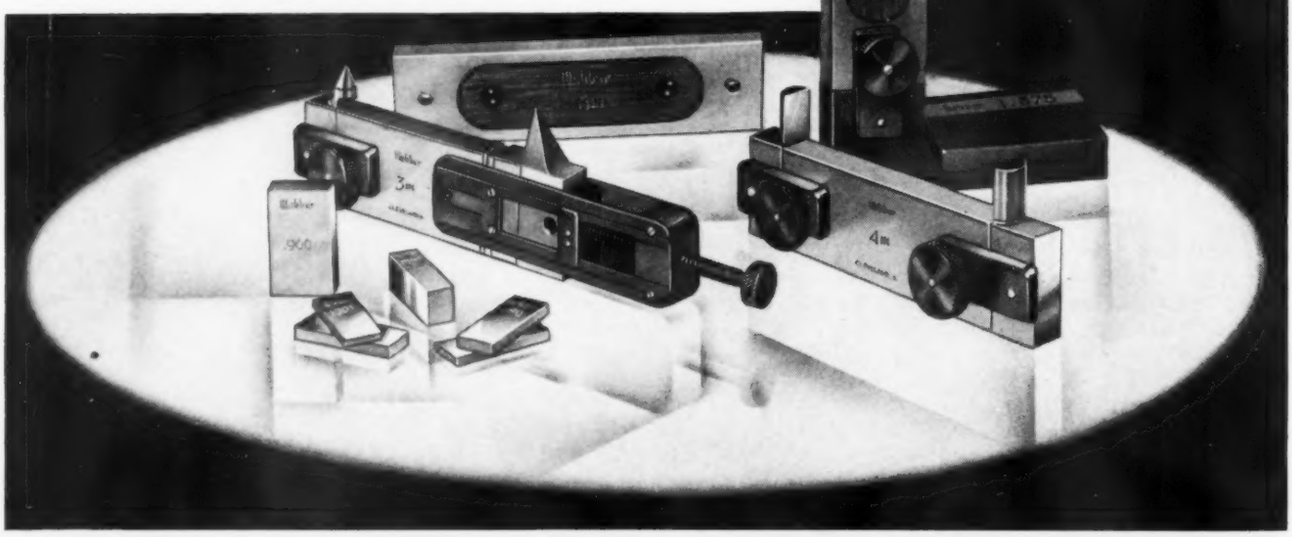
The Heavy Duty Gages illustrated are practical precision tools for use in shop—tool room—and inspection operations. They can easily and quickly be built up into height gages—inside or outside calipers—dividers for layout work.

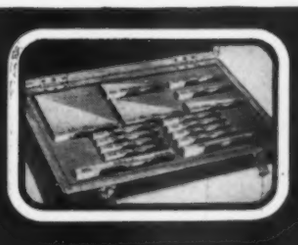
For gage blocks that adapt themselves to shop temperatures—that maintain their original precision over long periods—that provide greater flexibility in making precision measurements—specify Webber Heavy Duty Gage Blocks.

Prices:

Set No. 84-A	$350.00	Set No. 43-A	$185.00
Set No. 84-B	$235.00	Set No. 43-B	$150.00

Set No. 38-A (Thin Blocks) $195.00
Set No. 38-B (Thin Blocks) $155.00
Set No. 24-HD (Heavy Duty) $385.00
Capacity up to 24 inches
Set No. 36-HD (Heavy Duty) $450.00
Capacity up to 36 inches





Webber
GAGE COMPANY
12901 TRISKETT RD. • CLEVELAND 11, OHIO

Cold-Rolled Carbon Steel Strip—I

To clarify terms and practices in the steel industry, the American Iron & Steel Institute has issued "Cold Rolled Carbon Steel Strip," which is Section 13 in the Steel Products Manual.

Cold-rolled carbon steel strip is flat rolled steel not exceeding 0.25 carbon mean of range, ordered or implied. Coils and flat cut lengths are produced in the range of sizes tabulated by width and thickness. The material is manufactured in a variety of qualities, tempers and conditions of finish, which are designed to insure suitability for specific uses. These attributes are attained with standard or special manufacturing processes. Certain classifications of temper, finish and edge are used to describe cold-rolled strip.

Standard tempers are divided into hard and soft tempers. The Rockwell hardness of hard temper strip is not less than B-84 for thicknesses of 0.070 in. and heavier, and not less than B-90 for thinner strip. Soft tempers have lower Rockwell values plus useful combinations of physical properties. These soft tempers are established for plain carbon steels, carbon not over 0.25% for No. 2 temper and not over 0.15% for Nos. 3, 4 and 5 tempers. The amount of deformation that may be expected from each grade is stated in the following definitions and further shown in the illustration:

No. 1 or *Hard Temper*—a very stiff springy product intended for flat work only—not suitable for bending.

No. 2 or *Half-Hard Temper*—moderately stiff, can be bent 90° across direction of rolling and to a raduis equal to the thickness, but not less than 0.010 in.

No. 3 or *Quarter Hard*—medium soft, suitable for forming, bending, and limited drawing, can be bent flat across direction of rolling, and to 90° with direction of rolling, using a radius equal to thickness but not less than 0.010 in.

No. 4 or *Skin-Rolled Temper*—soft and ductible, suitable for fairly deep drawing without stretcher strains. Can be bent flat in any direction. Equivalent names are skin-rolled, planish-rolled and pinch-passed.

No. 5 or *Dead Soft Temper*—soft and ductile, suitable for difficult drawing where stretcher strains are not objectionable. Can be bent flat in any direction.

No. 1 or *Dull Finish*—without luster, produced mechanically or chemically, suitable for lacquer or paint adhesion, reduces contact friction when drawing.

No. 2 or *Regular Bright*—luster produced by rolls having moderately high finish, is suitable for average requirements, but not generally applicable to plating unless ground or buffed.

No. 3 *Best Bright Finish* (Special)—particularly suited to electroplating. Established practice requires that only one side of the strip need meet the surface finish specified. If both sides must meet the surface conditions imposed, this fact should be specified.

Standard Size Specifications

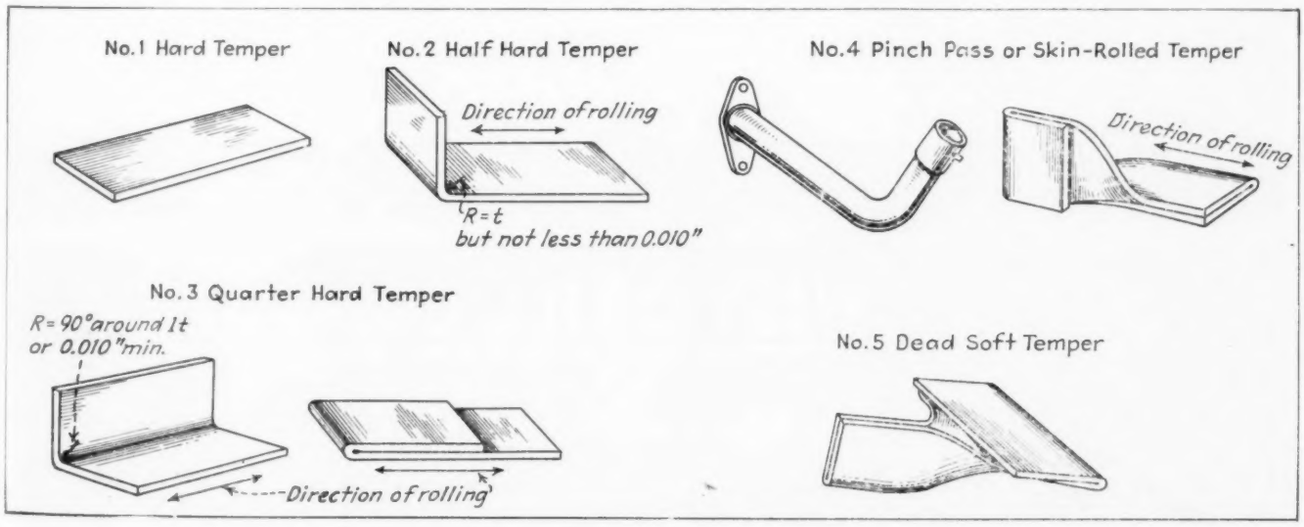
Thickness In.	Widths, In.	
	Up to 12	Over 12 to 24
0.2500 and thicker	.....	Strip (2)
0.2499 to 0.0142	Strip (1)	Strip (2)
0.0141 and thinner	Strip (1)	Strip (2)

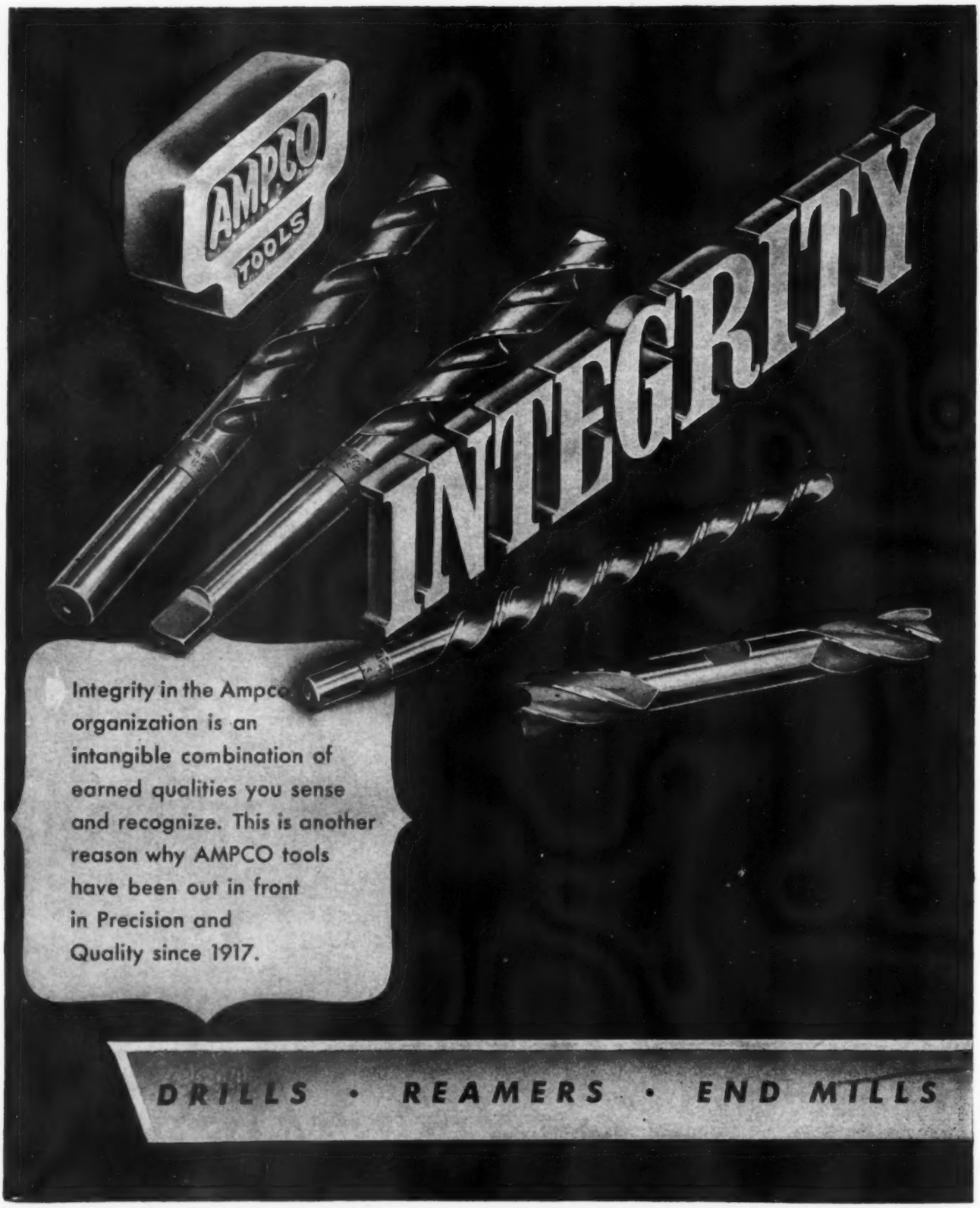
(1) Exception: Flat cold-rolled steel ½ in. and less in width with cross-sectional area not over 0.05 sq. in., when supplied with edges rolled or prepared, is classed as flat wire.
(2) When a particular temper as defined in A.S.T.M. Specification A 109 or a special edge, or a special finish is specified.

CROWN TOLERANCES

Tolerance for thickness at center of strip shall be that for the edge measurement plus the following:

Thickness, in.	1" to 5" Wide, Incl.	Over 5" to 12", Incl.	Over 12" to 24", Incl.
0.005 to 0.010, incl.	0.00075"	0.001"	0.0015"
Over 0.010 to 0.025, incl.	0.001"	0.0015"	0.002"
Over 0.025 to 0.065, incl.	0.0015"	0.002"	0.0025"
Over 0.065 to 0.187, incl.	0.002"	0.0025"	0.003"
Over 0.187 to 0.250, incl.	0.002"	0.0025"	0.003"




AMPCO
TOOLS
INTEGRITY
Integrity in the Ampco organization is an intangible combination of earned qualities you sense and recognize. This is another reason why AMPCO tools have been out in front in Precision and Quality since 1917.
DRILLS • REAMERS • END MILLS

AMPCO TWIST DRILL COMPANY

FACTORY AND MAIN OFFICE
Jackson, Michigan

CHICAGO ☆ DETROIT ☆ PHILADELPHIA

Gaging Business

Price Ceilings Cracking

The pending boost in steel prices will be the beginning of the end for many OPA ceilings throughout fabricating industries. In the final analysis, the users of steel will have to be paying higher prices for this raw material and also meet labor demands for higher wages in their plants, which will serve to double the impact of the higher labor costs. This means demands by various industries for price relief from OPA ceiling will increase sizably over the next few months. It is expected that labor peace in some other industries than the steel industry will have to be purchased by the government by raising price ceilings.

As it is, refusal of OPA to grant price advances in many metal working products or to remove price ceilings altogether is contributing to restricted production in many lines. In some cases, concerns bound by OPA price ruling complain bitterly because they cannot increase prices to compensate for rising costs, though a company making the products for the first time is not so restricted.

Expansion Tied Up By Strikes

Regardless of how soon the current labor trouble will be patched up, industry will be many months behind on its expansion plans running into the billions of dollars. Reports across the nation indicate construction work held up by strikes, and expansion plans deferred by labor uncertainty. Major companies in such predicaments include General Motors, International Harvester, Westinghouse and many others from coast-to-coast.

The delay in expansions will not only stem from the actual time that work thus far in 1946 has been tied up, but also from construction difficulties that will crop up as a result of shortages of materials from strike-bound plants. At the same time, plants planning to replace old equipment or add more equipment to existing plants have been holding up the placement of new orders pending a more peaceful labor situation.

Machine Tool Demand Off

Machine tool incoming business has shrunk substantially the past few weeks. Foreign buying likewise has lagged. Russia is not placing many orders just now; those orders that are placed are mostly for special machines. At least $3,000,000 of the $100,000,000 granted by the Export-Import Bank to Belgium will be spent in this country for machine tools and other plant equipment. Makers of general purpose machine tools are finding that surplus sales are cutting in more and more on their orders for new machines. This kind of competition is expected to increase.

Machine tool business from France is likely to be considerably more restricted than was anticipated, as only eight French dealers are permitted to import machine tools, and that means that only their principals will receive orders from France. One factor, not hitherto contemplated that may reduce the need for U. S. machine tools in European countries is the removal of German factories for reparation purposes and as a guard against future German aggression, to countries nearby for their use.

Since electric motors are required in equipment production, the strike in the electrical manufacturing industry will hit equipment builders' output very shortly, as well as other industries.

1945 Record Good

Despite dire predictions made months ago, the 1945 shipments of machine tools totaled $407,315,000, which was only about 20% below the 1944 level. Total orders placed last year came to $450,493,000, of which some $122,972,000 were cancelled.

December, 1945, shipments aided the year's record with the total for that month coming to $23,276,000, which was close to the November level of $23,700,000. Cancellations were few, totaling $1,700,000, as against $2,500,000 for November. New orders placed last month rose to $31,600,000 from the $23,700,000 received by the industry in November. At the year-end, the industry's backlog came to $178,972,000.

IN BRIEF

NEW YORK—Belgian machine tool buyers may now purchase U. S. machines without going through a Belgian government purchasing commission. This means restoration of individual relationship between buyer and seller. Belgian manufacturers, however, must secure permission to use dollars for importation of machine tools, proving essentiality of purchase.

. . .

LONDON—Chief innovation in Britain's current annual census of production is the plan to gather complete statistics on capital assets, indicating whether manufactured in Britain or abroad. The number, types and capacity of the principal machines and their value will also be noted.

. . .

PHILADELPHIA—Much progress is being made by a local manufacturer in getting ready for the market the first air-conditioned intra-city bus. Bus engine is located on its side under the middle of the bus where repair is easy. New springing is a bus feature.

. . .

WASHINGTON—The strike of Mexican workers in lead-silver mines for a 40% wage increase, combined with the sudden increase in British lead prices to 7¢ a pound (U. S. price is 6½¢), is cutting down normal U. S. imports of lead from Mexico, Canada and Peru. Our stockpile is around 75,000 tons, of which some 25,000 tons monthly are being allocated to domestic users to meet the gap between current consumption of around 70,000 tons and domestic production of about 48,000 tons. Unless the U. S. price is also increased, it is predicted that restrictions on lead uses will be reimposed if the situation does not ease.

. . .

SYDNEY, AUSTRALIA—The much-heralded Australian motor car will not make its appearance before 1947. Almost the entire Australian industrial capacity has been tied up due to labor disputes. Meanwhile, demand here for cars and trucks is urgent. In 1945, only 1,306 car chassis and 5,273 truck chassis were imported, as against 57,187 car chassis and 12,596 truck chassis in 1939.

Machinists' Strike Slows West Coast Production, Expansion, Surplus Sales

SAN FRANCISCO — The strike of AFL and CIO machinists in the San Francisco Bay area, as far as labor and management getting together is concerned, has shown no sign of lifting. Activity, however, has been noticed in the currents and eddies that surround a strike, with machinists beginning to lose faith in their officials, other unions becoming critical of tactics used by machinists' leadership, and the general public slowly realizing that the economy of the area is gradually being affected.

A few unofficial spokesmen for the employers have voiced the opinion that the 30% raise demanded by the unions is not so much of a problem as is the term "or else" used by union leaders in asking for the increase. While they are ready to sit down to arbitration, the unions are not, and this lack of cooperation causes fear that the union's attitude is not based on true American labor principles.

Expansion Deferred

Expansion programs by several large companies are being held up pending outcome of the strike, and in a few cases industries are threatening to move from the area, fearing the new higher wages will not be conducive to profitable operation. This lack of confidence is shown by such companies as Western Crown Cork & Seal Co., which is holding plans in abeyance for a new plant for which it recently purchased property; The Joshua Hendy Iron Works, which is reported to have stopped plans for San Francisco expansion; and a $500,000 plant expansion ordered halted by the Link-Belt Co. Matson Navigation Co. expects to get its four luxury liners back from the War Shipping Administration in the near future and plans to spend $3,000,000 apiece reconditioning them for the passenger trade. This work, company officials say, will have to be done in Los Angeles or Seattle if the machinists' strike isn't satisfactorily settled. Although struck plants have, in most cases, large backlogs of work on their books, their management is fearful that future orders are now going to competitors elsewhere who can assure delivery.

Surplus Units Strike-bound

Effects of the strike are being felt in shops other than closed ones. Plants whose products, such as castings, are used by struck plants, have practically halted production because of lacking storage space. The RFC's plans for disposal of surplus machine tools are in the doldrums because many of these are now in struck plants and can't be moved; some are in storage but prospective purchasers, unsettled in their hopes for a bright postwar future, are hesitant to buy.

With RFC's new subsidiary, the War Assets Corp., trying to dispose of the large quantity of tools and equipment acquired for the area's war production, representatives of eastern-made machine tools are not optimistic about moving their products. Metalworking shops have their eye on RFC machines, either already installed in their own shops as DPC property, in other shops, or in warehouses, and are anxious to lay the cash on the line. Some of them have expressed annoyance at the inevitable government red tape involved in making a purchase, but RFC officials here say personnel is short.

Basic Prospects Good

The attitude of most owners of metalworking shops is that when strike difficulties fade business is ready boom. Most plants expect to hold their wartime production personnel, with some even hoping for larger forces than during the war. A few even contemplate returning to a third shift. Those plants requiring conversion to different products seem to be taking the changeover smoothly, and their only problem seems to be hiring workers skilled in their respective fields. Many machinists were trained here during the war, and are still available when they get ready to go to work, but even these will not be enough according to the more optimistic. Markets look good —so good that local chambers of commerce report weekly lists of large numbers of recently purchased factory sites, many of them eastern concerns viewing western and Pacific export markets with confidence. More than a few Bay area industries are even looking to expansion of eastern markets for their products.

WAR ASSETS CORP. FORMS SURPLUS TOOL GROUP

A committee has been appointed by the War Assets Corp. to lay out a broad procedure for the disposal of surplus machine tools and allied equipment. The committee consists of two machine tool builders, two machinery dealers, two used equipment dealers, and two press manufacturers. Initial recommendations have been made to unify the procedures for the 32 different RFC offices.

Russia Launches 5-Year Machine Tool Program; Will Make More Special Units

MOSCOW—With Soviet machine tool works already filling orders for new machinery, the People's Commissariat of the Machine Tool Industry has announced the launching of an ambitious five-year output program aimed at insuring the renewal of existing plants after wartime wear and tear and the expansion of capacities.

Among the postwar lines already in production are semi-automatic lathes at the Krasny Proletary Works and specialized machines for the automobile industry at the Moscow and Kharkov grinding tool plants. The Orjonikidze plant in Moscow and Lenin plant in Sterlitamak are going over completely to the manufacture of multiple machine tools, and the Kharkov, Kiev, Vitebsk, and Minsk machine tool works now being restored will shortly resume operation.

The output of multiple-head machine tools in 1946 is to be nearly trebled over 1945 with a view to raising the figure to four and a half times the present level by the end of the five-year period. Each of these units will be able to do the work of eight to ten universal lathes with only one operator. Their manufacture, however, presents many problems inasmuch as most multiple-head machine tools will be original models and hence cannot be put out on the mass production principle. In view of this, factory designing offices are being expanded and reinforced.

Greater Productivity Sought

The latest types of machines to be produced will insure increased productivity of labor and a rise in output while requiring less operators. Automatic production lines consisting of these models will require only a few skilled operators. The first production line of this kind is now being made for the Kharkov Tractor Plant by the Stankokonstruktsia Works.

The People's Commissariat of the Machine Tool Industry has commissioned scientific research organizations to work out devices and methods making for a still higher degree of automatization of machine tools. The machine tool industry itself is scheduled for expansion and the output of both specialized and multiple-head machine tools is also scheduled for a substantial increase.

Detroit Letter

Expansion Plans Pushed

The dark outlook in the automotive industry is not deterring the Ford Motor Car Co. from not only pushing its postwar expansion plans but enlarging them. From an estimated $150,000,000 program, it has been stepped up to $200,000,000 and may go higher than that, according to an announcement by the company.

That it is not mere future thinking is shown in the fact that it has started an $800,000 sales and parts branch at Des Moines, Ia. Similar branches are under construction at Denver, Seattle and Houston. Two new assembly plants are planned for St. Louis and Atlanta and two Lincoln-Mercury plants at Metuchen, N. J., and Long Beach, Calif.

General Motors has at least a half billion dollar program and Chrysler expects to spend about $100,000,000 for its reconversion and expansion. The other companies are spending smaller amounts as soon as the situation simmers down.

Labor Outlook Uncertain

The labor outlook still is shrouded in doubt and anxiety. President Truman's fact-finding board failed to budge GM from its position on what it should give as an increase to the strikers of the UAW-CIO locals. Any hope that its recommendations would be acceptable to the corporation faded when it stated that GM could pay the 19½-cent boost in wages without raising prices.

This indirectly assailed the corporation's position that ability to pay should not be part of the wage negotiations. The fact-finders raised the same issue that caused GM to walk out of the hearings in Washington after one session.

And since then the corporation has been adamant. C. E. Wilson, president of GM, wasted no time in rejecting the recommendations and tossing down the gauntlet anew that all it would pay was 13½ cents an hour more. It refused to reinstate the old contract and insisted that the new contract must contain some modifications of clauses which had been forced on it by the government boards.

Ford Negotiation Aspects

So the situation still stands, a deadlock. Even Ford, which was expected to act liberally with the union to set the pace for the industry did not pick up the recommendations of 19½ cents an hour. It went to 17½ cents and there it stood as wage negotiations reopened last week. It pointed out that with the increase, it would be paying 26½ cents more than GM.

Another sore point in the offer to the union was that it would not become effective until production was stepped up. R. J. Thomas, president of the union, insisted that no wage boost could be tied up with production and any increase given must become effective immediately.

Kaiser-Frazer Deal Unusual

The ubiquitous Henry J. Kaiser sought to set a labor pattern for the automotive industry here by completing a contract with the union in record time. It was announced dramatically in a night session at Kaiser's hotel suite with President Thomas of the UAW proclaiming a victory for the 30 per cent wage boost stand of the union.

But Thomas was the only man who could see a 30 per cent wage increase in the contracts. It provided that the Kaiser-Frazer Corp. would adopt the present wage scale of its nearest neighbor, the Ford Rouge plant, of $1.19 an hour and would later add to it whatever GM gave its workers to settle the strike.

In addition, it embodied a new wrinkle. The company would set up a production "kitty" of $5 for every car produced at Willow Run. This kitty would be cut up at the end of the year and would be shared in by every worker who did not participate in an unauthorized tieup or strike and those who had been on the job at least 90 per cent of the time.

Kaiser Enthusiastic

So with two unknown quantities, the contract was accepted by both sides. It still remains to be seen what GM settles for and how many cars can be produced at Willow Run. The union vigorously denied that this was an incentive plan.

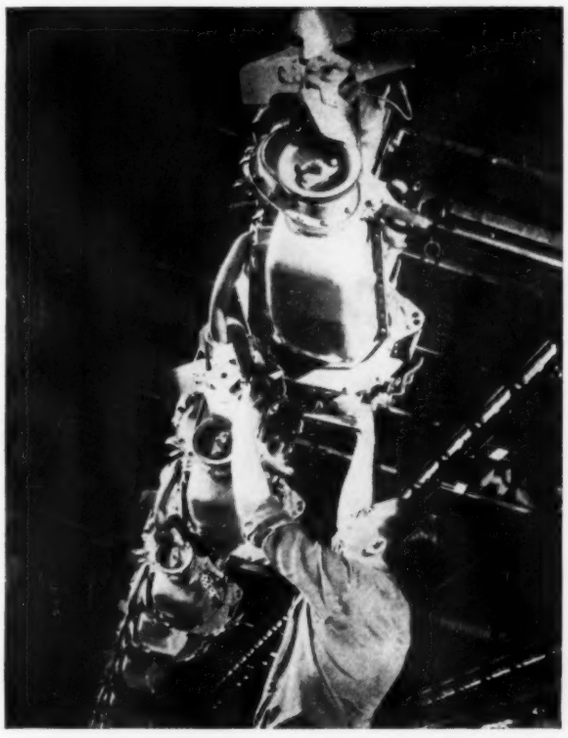
Kaiser was enthusiastic about labor prospects in his plants.

"I think it means more than just money," he said. "It will give every worker not only an interest in his own job but in the job of his fellow employe. It will give everyone the joy of achievement, which is greater than money."

Charles E. Sorensen still is making news in the industry. In a surprise move last week he stepped down from the presidency of Willys-Overland to become vice-chairman of the board of directors. Sorensen was said to be planning to devote himself more to the production side of the picture than he could as president.

Ford Output Leading

On the production front, Ford is leading the parade with a total of 50,000 cars produced up to last week. Nash, Hudson and Packard are staggering along, plagued by lack of glass. The Dodge and Plymouth divisions of Chrysler are in production on a limited scale but are eyeing their glass supplies with a careful eye. Just about the time they get dealers sampled, the glass is expected to be gone.



Studebaker's South Bend Plant Resumes Output—After a 13-week delay due to labor-management difficulties, Studebaker's South Bend, Ind., plant resumed operations on Jan. 4, giving employment to 8,000 workers. With sub-assemblies stored during the 13-week period, work was assured for some time. Here an inspector checks tags on engines on an overhead conveyor

London Letter

British Tool Exports

Soviet Russia has been the major purchaser of British machine tools, according to latest data made available by the British Board of Trade. Comparable figures for the first nine months of 1938, 1944, and 1945, show that Russia's share of Britain's machine tool exports rose from 38% prewar to 87% in 1944, and only declined to 75% in 1945. The accompanying table indicates that the bulk of other British tool exports went to Empire nations during the first nine months of 1945. Only $160,000 worth went to France last year.

The fact that Russia is still a major buyer of industrial equipment and recent reports of an increasing volume of French business being placed in Great Britain serve to explain reports of rather limited activity by the British in Latin America. With European inquiries at high levels and Empire nations clamoring for industrial equipment, it appears that British equipment exports to other areas will be extremely limited for the present.

Quality Emphasis Grows

Government officials and industrial designers fear that record demands for goods at home and abroad may tempt manufacturers to speed production to the point where "quality" will suffer, adversely affecting British products in world markets.

While waiting to reach peak production of quality goods, Britain is keeping a watchful eye on world trends to "buy American" because of the sales appeal of U. S. products. Despite the potentialities of any such trend, the British plan to produce goods compatible with her prewar slogan, "British Goods Are Best," and at the same time make sales abroad in competition with American products by adopting industrial designs having aesthetic appeal. No attempt will be made to copy American designs, and the British will then leave it to the world to "judge for itself."

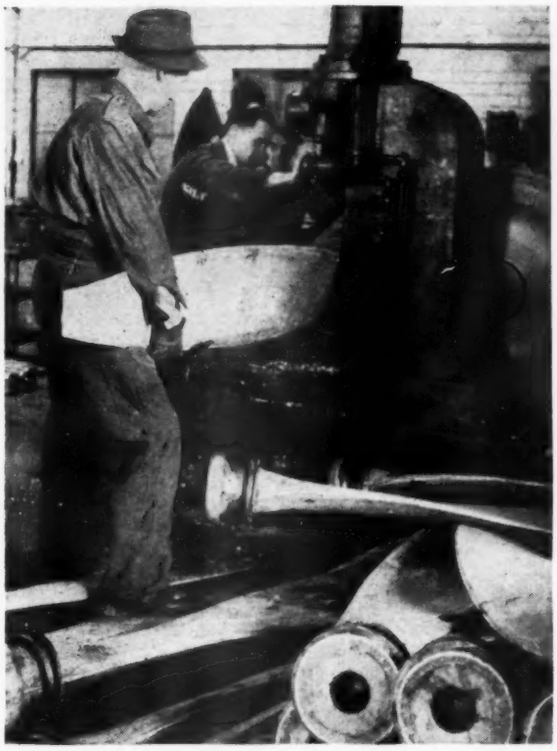
Industrial Design Show

The excellence of British design will be the keynote of the industrial design exhibition show expected to be held around the middle of 1946 at an as yet unnamed location. With the official title of "Britain Can Make It," the show will be Britain's first gesture to recapture and extend her world markets. The exhibition is sponsored by The Council of Industrial Design, and will be financed by the government. Space will not be sold; all products shown will be selected by expert committees.

BRITISH MACHINE TOOL EXPORTS AND IMPORTS

Type of Machine Tool	Jan.-Sept. incl., 1938		Jan.-Sept. incl., 1944		Jan.-Sept. incl., 1945	
	Weight tons	U. S. Dollar value (000's)	Weight tons	U. S. Dollar value (000's)	Weight tons	U. S. Dollar value (000's)
BRITISH EXPORTS						
Boring Mills	1,255	710	2,427	2,060	785	610
Drilling Machines	1,899	1,340	479	400	899	720
Grinding Machines	2,094	2,220	1,871	2,160	1,286	1,400
Lathes & Screw Machines	5,045	4,350	6,164	6,700	5,585	6,130
Milling Machines	1,348	1,280	3,028	3,740	1,344	1,620
Planing & Shaping Machines	2,651	1,270	1,929	1,490	1,701	1,150
Presses, Punches & Shears	1,103	440	3,738	2,860	1,324	1,025
Other Machines	2,696	1,890	3,706	3,250	3,188	2,645
TOTAL	18,091	$13,500	23,342	$22,660	16,112	$15,300
IMPORTING COUNTRIES						
Union of South Africa	1,315	885	758	650	910	775
India	1,171	785	172	140	254	320
Australia	1,677	1,190	482	600	783	740
Other British Dominions and Colonies	1,624	995	492	490	981	915
Russia	7,577	5,170	20,714	19,800	12,218	11,550
France	669	735	.....	.....	194	160
Japan	967	950	.....	.....	.....	.....
Other Countries	3,091	2,790	724	980	772	840
TOTAL	18,091	$13,500	23,342	$22,660	16,112	$15,300
BRITISH IMPORTS						
Lathes & Screw Machines	3,044	3,250	4,542	10,380	645	1,960
All Other Types	14,848	11,720	7,395	17,600	4,313	8,930
TOTAL	17,892	$14,970	11,937	$27,980	4,958	$10,890

Source: British Board of Trade



British Workers Convert Propellers Into Saucepans—As British industry recovered, surplus war products are finding various uses to meet the tremendous pent-up demand by domestic consumers and for export trade. Rings from the end of the propeller are being sheared here by British workmen prior to the balance being melted down for saucepan manufacture. Rings are sheared to prevent contamination of the metal in the propeller

Although individual companies will thus not be exhibitors and will not be expected to provide representatives, a catalogue for the exhibit will name the manufacturer of each product and means of contacting him. Plans are to keep the show open for three months.

Some British officials fear that their industry has generally fallen behind the United States in adding eye appeal to their products for the world market, and it is hoped that the value of good industrial design will gain wider acceptance and appreciation. However, the present difficult position of British industry may not make available in quantity or for general sale some new designs that will probably be exhibited at the show. Thus, an effort will be made to clearly explain the relative availability of newly designed products. Meanwhile, industry is being told that a show of "absolutely first-class designs, illustrating the creative originality of British manufacturers will afford a striking long-term advertisement for industry as a whole."

Products Exhibited

Most types of consumers goods will be exhibited from binoculars to baby carriages. In addition, interiors of civil aircraft, railway passenger coaches, buses, and ships' cabins will be on display. Models of all British ships, passenger and freight, will be exhibited.

The products selected for the exhibition will be grouped together by industries.

Canadian Wage Ceiling May Be Lifted; Few Strikes Going

OTTAWA—Canada's tight wage ceiling which, with the tacit consent of the labor unions has practically eliminated labor disputes over wages is about to be lifted in a month or two, provided they do not result in price increases. The wage ceiling is tied in closely with the control of prices and both are based on 1941 levels.

Despite the wage ceiling the average wage level of Canada did rise considerably during the war. By 1943, the wage index stood at 132.8 as against 100 in the 1939 base year. (Further increases have occurred since, but comparable figures are not available.) No wage increase was permissible without the approval of the National War Labor Board and that is still the situation. Since V-J day the board has interpreted its power to authorize increases more liberally.

Controls to End

Very shortly, however, increases within a limited margin will be permitted without application to the board. That will restore collective bargaining by itself to its normal role in determining wage rates. Policy of the administration, as stated by Labor Minister Mitchell, is to get out of wage control as rapidly as possible.

Most of Canada's recent labor troubles and notably, the long strike at the Canadian Ford plant in Windsor, have turned primarily on the question of union security rather than wages. The Ford workers were seeking a wage increase but recognized the authority of the government board to say whether or not they should have it. The real issue between the union and the company was the union shop which the union demanded and the company refused to concede. In the final settlement that issue was left to the decision of an arbitrator, appointed by the Minister of Labor, Justice I. C. Rand of the Supreme Court of Canada. Left to negotiation subsequent to the arbitrator's decision was a demand for a year-round minimum wage.

Provinces Control Labor

Under Canada's federal system responsibility for property and civil rights which includes terms of contracts and most matters affecting labor relations rests with the nine provinces. Under war emergency powers the federal government took over and set up two boards: the War Labor Board to deal with wages and working conditions and the Labor Relations Board to deal with recognition of unions.

When the federal emergency powers lapse jurisdiction returns to provincial governments.

Collective bargaining is compulsory under the federal regulations and recognition of unions which are certified by the Wartime Labor Relations Board is imperative. Due to this legislation and also to the increase in industrial employment trade union membership doubled during the course of the war. The latest complete figure is for 1944 and was 724,188 compared with 258,967 in 1939. The metals industry with 193,336 organized workers accounted for 26.7 percent of the total union membership and was the largest single group.

Cost of living rose early in the war but the rise was checked by the application of the price ceiling at the end of 1941. The index of cost of living now stands at about 119 based on 1939 at 100.

Unions Favor Ceilings

As the end of the war approached major labor organizations backed the government's policy of continuing price controls during the reconstruction period and tacitly agreed to avoid attempts to break the wage ceiling. The administration's aim is to hold the line on prices and wages.

The packing industry and the automobile industry have provided instances of demands from labor for a take-home pay equal to their wartime pay which included overtime. The packing house industry wage dispute was settled by a compromise after the government took control of the industry when the union voted to strike on the basis of an increase in pay approved by the War Labor Board at the rate of about 15 percent.

Higher Steel Prices Inevitable; Users Will Require Higher Prices For Products

PITTSBURGH—A major outcome of the national steel strike is the generally higher price level that will prevail, forcing greater pressure for price relief on finished products by steel consumers. Non-integrated steel producers will be further squeezed, unless some sort of relief is granted them. They not only face the problem of increasing wages in their own plants, but will have to pay more for semi-finished steel.

While higher prices do not temper demand for steel, many industries will press OPA for higher prices on their products to compensate for part or all of their higher costs for steel. Such relief will be needed promptly, since few consumers had large inventories before the steel strike.

85% of Industry Down

The national steel strike affected about 85-90% of the industry's capacity. Sole exceptions to the walk-out were plants in certain states where labor laws provided for a 30-day "cooling off" period, and the Weirton plant which has an independent union. The daily production loss due to the strike is set at some 200,000 tons of ingot steel. Little of this production can be made up later, since all mills had been operating finishing facilities at maximum rates to meet the heavy backlogs burdening the industry.

Just before the strike, U. S. Steel offered the CIO 15c an hour, or 60% of the union's original 25c-an-hour demand. The union brought its demand down to 18.5c, as suggested by President Truman, but this was rejected by U. S. Steel. The steel company pointed out that such a wage grant would force steel price increases that would constitute a hardship to many small plants.

Predictions were that most steel-consuming industries would be hurt within two weeks, unless the strike was ended, since inventories were generally low. Steel foundries, one of the nation's critical reconversion bottlenecks, will be hard hit by the steel stoppage, since they will be unable to get pig iron which had been in inadequate supply before the strike.

Labor Trouble Dominates Chicago Scene; International Harvester Expanding

CHICAGO—The chief immediate concern of the metal trades industry in this area, of course, is the same as that in the rest of the nation—labor. The one week reprieve of the steel strike led to frantic attempts in the Chicago region mills to undo the preparations made earlier to close down. Gear makers are still closed by strikes. International Harvester was shut down by a strike January 21.

In contrast, it was interesting to note that the latest report on unemployment and pay rolls in the Chicago area showed that there were sizeable increases in the metal trades, and that unemployment in the manufacturing group turned upward for the first time since December, 1944. The gray iron founders in the Chicago area, who have been beset by a variety of difficulties, have not yet been faced with demands for increased pay. The contracts with the unions, however, expire here April 31, and local foundrymen expect to start negotiations on new contracts at the end of March.

Foundries At 50%

The foundries in Chicago, faced by an "almost inconceivable" demand for gray iron castings, are only producing at approximately 50% of capacity. Although materials have been easier, and unskilled labor less scarce, the foundries are faced with an acute shortage of skilled help.

Chicago metal trades circles are speculating about the disposal of the giant Dodge Chicago plant, which the government—thus far unsuccessfully—is trying to sell or lease. No bids have been received for the plant by RFC, it was learned. The land and buildings of the "world's largest factory" cost the government $70,000,000, and the tools and machinery in the plant cost $100,000,000.

One possibility mentioned is the splitting up of the factory into four or five units for separate disposal. Another is the use of the space as a warehouse for surplus government property.

Harvester's Expansion Plans

A spokesman for International Harvester Company, which has been rumored to be interested in the Dodge plant, declared that "we have bought all the government plants we intend to." Harvester has just acquired the former Republic Aviation Corporation plant near Evansville, Ind., for $5,648,000, and intends to use the factory for the manufacture of home and farm freezers, household refrigerators, milk coolers and motor truck refrigeration equipment. The company hopes to get new tools and equipment delivered to the plant in time for production to start this summer.

Including the recent purchase of the Melrose Park Buick plant for $13,750,000 from the government, Harvester intends to spend between $100,000,000 and $150,000,000 for new plants and equipment.

The farm implement maker has great hopes for its new small tractor, to be produced at a new plant near Wood River, Ill., but it is known that Harvester executives are somewhat disappointed over the results thus far of the company's cotton picker. Engineers have not been able to get the costs down sufficiently.

Plastic Engineers Discuss Dies, Fixtures; New Officers Elected

DETROIT—Means of increasing production by using plastic dies and fixtures both in machining and assembling metal parts featured the technical discussions at the Society of Plastic Engineers Annual Meeting, held in conjunction with the Plastics Exhibit from January 7-11. Technical sessions were held on January 7, 8, and 9 accompanied by educational lectures on such subjects as: materials, molding technique, product design, tool design, and coatings.

At the tool design session, B. F. Hantz, American Insulator Co., discussed compression and transfer molds, which he said could not be made cheaply or in the usual toolroom. In making dies for this purpose, considerable pre-engineering is required. Where dies are made for cold molding and subsequent baking after molding the cost can be cut.

Tooling With Plastics

At the same session, W. W. Broughton, National Lead Co., reviewed the possibilities and limitations of "Kirksite Plastic Molding Tools" for forming plastics, and Clinton Rector, Catalin Corp., explained the possibilities of tooling with cast plastics. Kirksite was used during the war to stamp sheet aluminum parts, and when dies became obsolete the metal in them (zinc, copper, aluminum and magnesium) was completely recoverable. It can be cast in sand or plastic.

Mr. Rector stated that his company's plastic was widely used during the war for making intricate jigs and fixtures for assembling parts. It is particularly useful for small production runs, but it also permits molding large sections in a strong material by pouring the plastic into a plaster mold, usually made from wood mockups.

New officers of the Society include: G. W. Clark, Owens-Illinois Glass Co. as president; H. J. McGowan, Bakelite Corp., as vice-president; T. E. Orr, Plastics Engineering Inc., as secretary; and J. O. Reinecke, Barnes & Reinecke, as treasurer.

Washington Bulletin

Administration For Raises

The Government's labor policy, if it has any, is difficult to understand. Some insight is afforded by the observation that this is a "high wage" administration. The Treasury wants high wages for taxes; Wallace wants them for "social" gains; Chester Bowles, OPA Administrator, is the only high official talking low prices in comparison with wages. The President seems mainly concerned with getting full production of goods to absorb the excess money and head off inflation. But he is still willing, as in the case of steel, to risk "a little inflation" in order to have both high wages and high production.

More disappointments may come after the tide of wage strikes and price disputes has subsided. Compromise of wage demands probably will be followed by an epidemic of jurisdiction strikes between AFL and CIO and inside of each. And the bitterness of present strife is bound to carry over in the form of inefficiency, curtailing production. Seniority questions, as between older workers and returning veterans, are already a headache.

Cutting Nazi Steel Output

Germany's steel production will be cut from the pre-war rate of about 22,000,000 tons per year to 7,500,000 tons, according to decision of the Allied Control Council. The difference in facilities will have to be moved out of Germany to other countries having reparations claims against Germany. The claimant countries will displace Germany as steel purveyors to Europe; they will produce less efficiently, and thus disturb the economic balance of Europe, which is what the British were objecting to. The Russians participated in the Council's agreement, but probably will do as they please.

Government Agency News

Department of Commerce is distributing a bulletin called "Credit Sources for Small Business," It tells in detail the types of credit extended by banks, industrial banking companies, small loan companies, factors, sales finance companies, insurance companies, and many others. It says that many banks are not setting up special small business departments.

Surplus Property Administration says that the nation's aircraft industry can use only one third of wartime airframe plants and only one sixth of government built engine plants. SPA's report says that most of the 305 plants, which cost $3,800,000,000, are adaptable for use by other industries, and urges that they be disposed of quickly in the interest of re-employment and reconversion. So far the Army and Navy have asked that only 10 large airframe plants and 4 large engine plants be kept in peacetime standby for security.

Civilian Production Administration (WPB) has amended inventory controls which permitted plants in which work stoppages had occurred to postpone or cancel materials orders. Direction 6, Priorities Regulation 32, now says that continued receipts of materials are permitted beyond the 30-day period when necessary to bring the resulting inventory up to the maximum needed for the first 45 days after resumption of production.

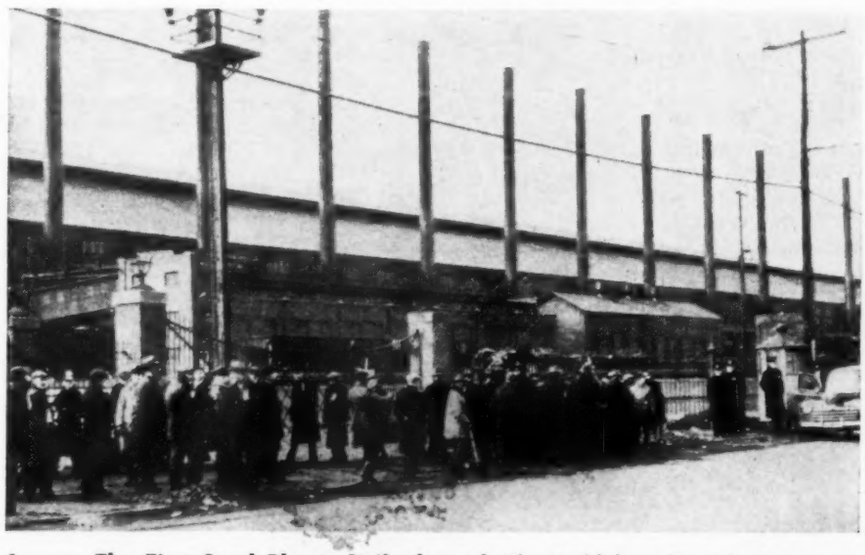
May-Johnson Bill Killed

The May-Johnson bill, which would have tied up atomic development work in government control, has been killed by a group of scientists from the Hanford, Oak Ridge, and Los Alamos (N. Mex.) projects, calling themselves The Federation of Atomic Scientists. These are the people who demanded attention on Capitol Hill during hearings on the bill. They express satisfaction with the new bill, S-1717 introduced by Sen. McMahon, and some say that spokesmen for the Association wrote it. The bill provides that atomic research shall be permitted by private interests, under license, and that data shall be exchanged freely. A civilian commission would take over all of the Manhattan District's property, materials, and records.

New Chairman of War Assets Corp.

Lt. Gen. E. B. Gregory

The former Army Quartermaster General has become chairman of the board of the newly formed War Assets Corp., which on January 15, 1946 took over the surplus property activities of the Reconstruction Finance Corp.



Among The First Steel Plants Strike-bound—The Bethlehem Steel Lackawanna plant was strike-bound on January 14th, even though the CIO's nationwide strike was postponed a week. The 11,000 workers walked out because of "other grievances," even though wage rise negotiations were continuing on that date. On January 21, some 750,000 CIO steel workers were on strike

Over 500 Machinery Builders, Dealers, And Distributors Sign Up With WAC

WASHINGTON—More than 500 machinery manufacturers, dealers, and distributors had signed up, by January 15, with RFC's War Assets Corporation, to sell government-owned surplus machine tools and production equipment under the new 12½% commission arrangement recently authorized by RFC and the Surplus Property Administration.

The dealer-agent appointments were made by the 31 RFC (now War Assets Corporation) regional offices. In addition to the appointments already made, more than 550 applications have been received for consideration.

On January 15, at the close of business, War Assets Corporation assumed surplus property disposal functions formerly exercised by RFC's Office of Surplus Property—not to be confused with the Surplus Property Administration, a separate authority which makes overall surplus property disposal policy.

Response Pleases WAC

At first dissatisfied with the scarcity of applications for selling agencies under the commission arrangement, WAC now seems fairly well pleased, but is still seeking new machinery dealers and distributors, and used machinery dealers, who may apply for appointment. They should apply on forms which will be provided by the nearest WAC regional office. Also eligible are any persons with machine selling or adequate engineering experience. Their qualifications will be considered by regional directors.

Applications from qualified veterans are given "particular attention." It is known that veterans are often sent to Washington by supporting interests to front for them, not only in RFC but in other agencies. However, there is no harm done, because their resources and plans are always investigated, for their own protection as well as for that of the government.

WAC expects that this action to utilize "normal trade channels" will aid the current direct disposal procedure, which is continued, and also will expedite the sale of machine tools to all levels of the industry. Under the sales agency procedure, says WAC, it should become easier for smaller plants to purchase modern industrial machinery and equipment to replace worn-out equipment.

$137,444,000 Sold

Up to the effective date of the approved dealer plan, $137,444,000 worth of machine tools and production equipment had been sold for $71,693,000. The total declared surplus, was $660,375,000, exclusive of an estimated $495,000,000 in the inventory of plants declared surplus, which is to be sold with the plants. Available for sale as of December 15 was $518,827,000 of machine tools and production equipment.

Sales for October and November were approximately double those of August and September. Sales for December, estimated on actual sales for the first two weeks of that month, are double each of October and November. Operation of the approved dealer system will acelerate the rate of sale, WAC believes.

Progress of the disposal program is shown in the accompanying table giving sales of equipment against inventories for the past 5¼ months.

BLS Productivity Data Attacked at Conference Board Session

NEW YORK—The work of the Bureau of Labor Statistics, Labor Department, on productivity data was upheld and attacked in a round-table discussion at the January 17th meeting of the National Industrial Conference Board. Solomon Fabricant, formerly with the bureau, and W. D. Evans of the BLS, explained the working of such data and admitted some shortcomings. On the other hand, Allen W. Rucker, president, Eddy-Rucker-Nickels Co., highlighted the hidden factors tending to make the figures meaningless, and stressed the frequent failing of wage incentives. Mr. Rucker felt that the most practical incentive plan would be one based on long-range profit sharing.

GM Productivity Down

Despite these pros and cons, Andrew Court of General Motors showed how his company had obtained quantitative data on one particular sub-assembly for autos made in their plants in 1941 and in October, 1945. He showed, piece by piece, how General Motors' was down 37%, of which 21% was due to reduced worker effort, 8% to green help, 7% to inefficient tooling up, and 1% to plant reconversion problems. He recalled that Henry Ford II recently stated that Ford productivity was down 34%.

In a general session the same evening on "What Causes Strikes?", Charles M. White, president, Republic Steel Corp. openly blamed the government's deliberate bias in favor of labor for our present national difficulties, and stated that law enforcement has been virtually ignored whenever there are strikes. He warned that the greatest menace facing us today was the open and powerful attempt of the CIO-PAC to completely remake our government into some form of labor-socialism, or worse. Pointing out that the Little Steel Formula would call for a 32% wage increase over the 1941 level, he said that Republic has followed that policy, but the CIO is now demanding 30% more. This leaves industry faced with a job that the government cannot do any longer.

U. S. Misinterprets Facts

In discussing conflicting wage theories, Leo Wolman, Professor of Economics, Columbia University, stated that the government for a long time has been expounding a lot of misinterpreted facts to warp the nation's train of thought. Thus, he added the biggest job facing us today is the simple and clear correction of the many wild misconceptions so firmly rooted in all of us. He compared today's catch-words with those after World War I, when it was "capacity to pay," and it later became "cost of living," and then "productivity." He said, "A theory to be acceptable must be plausible and attractive."

These two speakers, and Thomas L. Parkinson, president, Equitable Life Assurance Society of the United States, who spoke on "monetary manipulations," were introduced by the chairman of the meeting, Virgil Jordan, president, National Industrial Conference Board. Mr. Jordan was not very enthusiastic about the current chaotic labor scene, which he described in colorful fashion.

SURPLUS EQUIPMENT SALES RECORD

	Acquired for Disposal	Sales	
		Cost to Gov't	Sold for
Accumulative through June 30, 1945	$214,902,000	$75,550,000	$43,934,000
July	14,673,000	6,418,000	3,158,000
August	13,891,000	5,647,000	2,095,000
September	41,097,000	5,828,000	1,996,000
October	107,170,000	12,094,000	5,299,000
November	146,720,000	16,467,000	7,702,000
December 1-15	121,922,000	15,440,000	7,509,000
Total through Dec. 15, 1945	$660,375,000	$137,444,000	$71,693,000

Spotting the Air News

Nazi Reports Disappointing

Aircraft and many other industries are disappointed with industrial reports on Germany, written by experts on the ground, and currently being released by the Commerce Department's Office of the Publications Board. Many of the papers are interesting, but not one in ten contains data of use to American industry. British and U. S. technical groups sent to Europe had no over-all direction or coordination, and many of the members frankly made a Cook's tour of their jobs.

Servicing Export Planes

Export Committee of the Aircraft Industries Association proposes an overseas service corporation, to be jointly owned and operated by makers of planes sold to foreign governments and persons by the U. S. Foreign Liquidation Commission. Satisfied owners of these war surplus airplanes, AIA feels, is the best possible promotion of continued sales abroad by American manufacturers. Chief competition is the British.

Carrier Takeoffs

Since the beginning of military aviation, the flight performance of deck-based Naval airplanes has been limited by necessary short-run landing and takeoff characteristics. Navy fighters nearly caught up with landplane performance during the war. The deck base handicap all but disappears with development of the all-jet FD-1 Phantom fighter for Navy, by McDonnell Aircraft Corp. Latest rocket assist and catapults enable it to take off under unfavorable ship-speed and wind conditions. (Jet power is inefficient in the takeoff.) The FD-1 climbs to about 40,000 feet; makes over 500 mph.; climbs fast; has a range of 1000 miles; weighs less than 10,000 pounds in combat trim; has twin Westinghouse axial flow turbo-jet plants.

Light Planes

Curtiss-Wright claims the world's lightest weight per h.p. in its new Cyclone 9 type engine, which develops 1 h.p. for each .85 of a pound, dry weight. Advancements in cooling, supercharging efficiency, and structure, permit increased output from given displacement.

It will be a long hard pull for light aircraft to match automobile prices, but progress is being made. Cessna Aircraft, of Wichita, quotes $2495 for its Model 120, all metal except wing covering, two seats, 85 h.p., 125 m.p.h.

Propeller Controls

An airplane with a fixed-pitch propeller is much like a motor vehicle with one speed. For years all transport and tactical military planes have had automatic variable pitch blades, for efficiency in takeoff, climb, cruise, and speed. Now, the big planes are getting reverse in addition to variable pitch, for smooth braking, and for braking on ice or wet pavement Latest thing is variable pitch, until recently regarded as too heavy and too costly, for personal aircraft. Several automatic (centrifugal) types have been developed. Continental Motors now announces hydraulic control for light propellers.

Cutting Aircraft Noises

One serious obstacle to private flying is complaints from airport neighborhoods about noise. There is disagreement whether the engine or the propeller makes the most racket, but both make plenty. Solar Aircraft announces a combination manifold, muffler, and heater, weighing less than 10 pounds, to curtail engine noise. There is no solution in sight for propeller noise.

NEW CONSTRUCTION AND EXPANSION

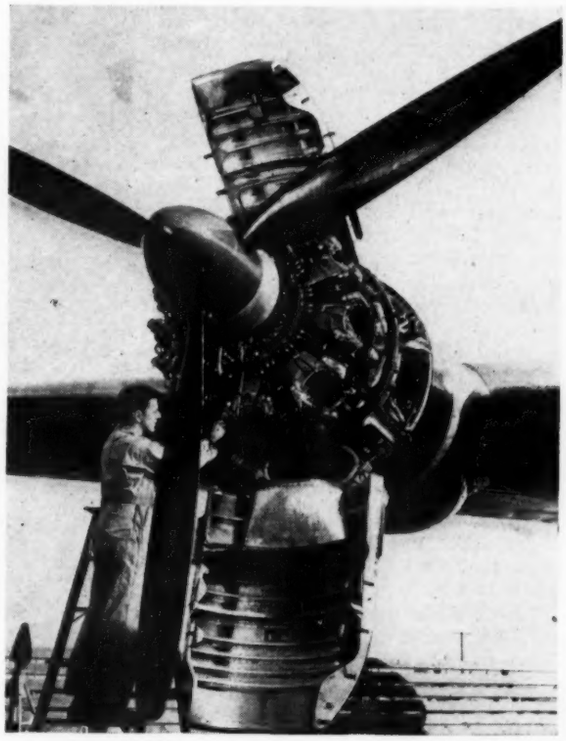
The Westinghouse Electric Corp., Pittsburgh, will spend more than $52,000,000 during the year for the continued reconversion and expansion of its plants. During 1945, over $8,000,000 was spent for similar purposes.

The Kaydon Engineering Corp., Muskegon, Mich. is working on a 12,000 sq. ft. addition to its plant, which should be ready for use the end of February. A considerable number of machine tools have been purchased for installation in the plant.

Reliance Electric & Engineering Co., Cleveland, will spend over $1,000,000 for a new building, necessary machinery and equipment and the acquisition of an additional plant for the production of smaller motor frames and the development of new products.

Ford Motor Co. is constructing four parts depots in Seattle, Denver, Houston and Des Moines as part of the company's $175,000,000 expansion program.

The National Radiator Co. has started construction of an extensive addition to its New Castle, Pa., plant. The addition of 11,000 sq. ft. of space will cost more than $235,000, including equipment. A new mechanical moulding unit will augment present facilities.



Gaping Jaw Metal Cowling for Plane Engines—New cowling design, recently announced by Lockheed as standard equipment for all *Constellations*, enables ground crews to save 15-20 minutes each time an engine is serviced or inspected. The new cowling arrangement consists of four main panels. The two side panels, hinged to the upper section, can be removed quickly without unfastening any pins or hinge bolts. This innovation will eventually help reduce airline fares

Henry Ford II Cites Strike Cost to Nation at SAE's Annual Meeting

DETROIT — Citing the 216,000,000 man-days of work lost through strikes from 1927-1941, Henry Ford II, principal speaker at the annual banquet of the Society of Automotive Engineers, stated that this idleness was expensive to the strikers, the companies, and the nation. He said, "When a production line stops, the jobs and purchasing power of hundreds of thousands of people in related businesses all over the country are affected." Discounting the possibility of legislation solving industry's labor problems, he said that industry could only look for an "improved and increasingly responsible union leadership for help."

Mr. Ford's talk, "Human Engineering," was a highlight during the SAE's annual meeting held here from Jan. 7-11. L. Ray Buckendale, engineering vice president of Timken-Detroit Axle Co., was announced as the newly elected president of the society, succeeding James M. Crawford of General Motors Corp. New members of the SAE council include: A. E. Raymond, engineering vice president, Douglas Aircraft Co.; A. J. Blackwood, assistant director, Esso Laboratories, Standard Oil Development Co.; C. E. Frudden, consulting engineer, Tractor Division, Allis-Chalmers Mfg. Co. In addition, eleven new vice presidents were also elected.

Plastic Body Construction

Among talks featured at the meeting was the discussion of new body material by William B. Stout, consulting engineer for Consolidated-Vultee Aircraft Corp. and Graham-Paige Corp. Proposing body construction using fiber plastics, Mr. Stout stated, "glass and equivalent fiber materials will soon be giving steel a run for lightweight structures,—not only because of greater strength and less weight, but because of cheaper fabrication methods, quicker production, more rapid turnover of material and stock."

Aircraft techniques and design applied to motor-vehicles suggests weight reduction and better structural use of materials according to Mac Short, vice president, Lockheed Aircraft Corp. An unusual suggestion was the use of colored dural of proper section, formed for use as bumpers with resultant saving of 100 lbs. or more in car weight.

Two critical materials, tin and rubber, were fully reviewed by E. T. Johnson, Chrysler Corp., and John Collyer, president, B. F. Goodrich Co. Neither saw an early return to adequate supplies due to the destruction of facilities and manpower in Malaya and other East Indian areas, which were the major sources for these materials prewar.

W. S. James, head of automotive research at Ford Motor Co., covered the requirements of an ideal transmission, pointing out the advantages of automatic transmission. He mentioned that some experimental designs are now being tried out providing a hydraulic pump on the engine and hydraulic motors on each rear wheel, thus eliminating all the gears now used in transmissions and rear axles.

Hydraulic Couplings Explained

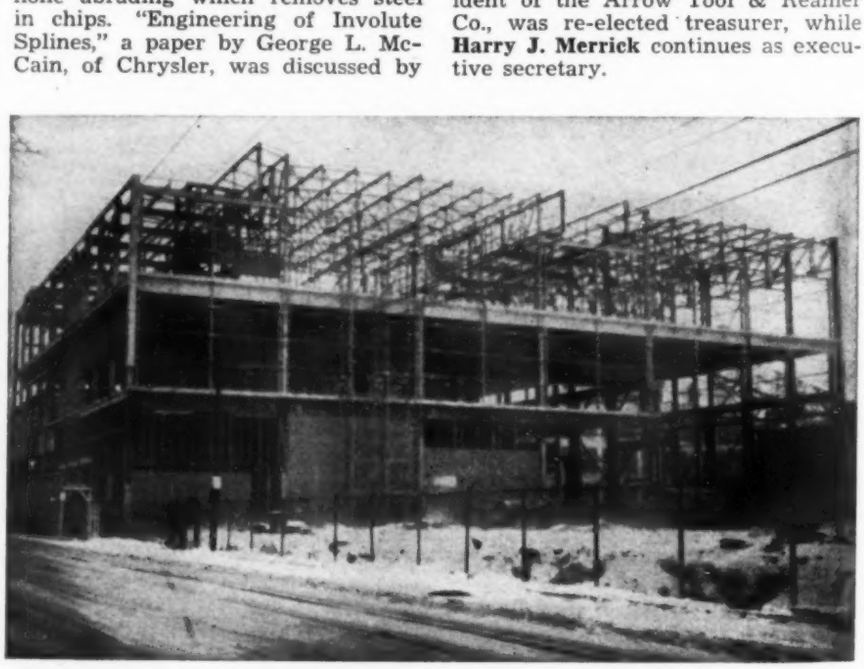
Two types of hydraulic couplings or torque converters were explained by A. H. Deimel, Spicer Mfg. Co., and Renke Brunken of White Motor Co., S. Johnson, Jr., of Bendix-Westinghouse Automotive Air Brake Co., reviewed the company's experience in operating fixture clamping devices by air. The concern now has 375 units in their plant operations, and average savings over hand-operated clamps has been about $25,000 yearly. Latest developments in honing were reviewed by Lawrence S. Martz and Douglas T. Peden of Micromatic Hone Corp. Their latest machines remove metal 25-30 times as was practicable formerly through a process called hone abrading which removes steel in chips. "Engineering of Involute Splines," a paper by George L. McCain, of Chrysler, was discussed by C. H. Stanard, Buick Motor, H. H. Gotberg, Colonial Broach Co., A. Beam, Vinco Corp., and S. O. Bjornberg, Illinois Tool Works. One of the pioneers in this development, Stanard explained the practical considerations; Gotberg outlined the problems of broaching the holes; Bjornberg suggested a new type of spline tooth; and Beam suggested a definite procedure for inspection and outlined the limitations of the various methods.

Other papers presented included: the use of synthetic lubricants, by D. B. Williams of Carbide & Carbon Chemicals Corp.; and specifications by J. L. McCloud, Ford Motor Co.

ASSOCIATION NEWS

American Society of Mechanical Engineers has sponsored the formation of a Machine Design Group. **J. F. Downie Smith,** head of the engineering department at United Shoe Machinery Corp., is chairman of the group, which has been organized primarily for the presentation of technical papers of interest to machine designers in general.

E. A. Goddard, general manager of Goddard & Goddard Co., Detroit, was elected president and **R. G. Mitchell,** president of the Eclipse Counterbore Co., was elected vice president of the **Cutting Tool Manufacturers' Association** at its second annual meeting held recently in Detroit. **R. H. Wolfe,** president of the Arrow Tool & Reamer Co., was re-elected treasurer, while **Harry J. Merrick** continues as executive secretary.



Buick Expansion Interrupted By Strike—General Motors strike held up construction of the new sheet metal and assembly plants at the Buick Motor Division. This is part of a $6,000,000 expansion program, including 3,000,000 square feet of new factory floor space

Names in the News

John S. Chafee

Fred Albrecht

John S. Chafee will join the Saco-Lowell Shops of Boston and Biddeford, Me. as vice president on Feb. 1. Mr. Chafee, who was with Brown & Sharpe Manufacturing Co., Providence, R. I. for over 20 years, served for three years on the War Production Board, most of the time as director of the Tools Division.

James D. Mooney, who recently resigned as vice president and director of General Motors Corp., has been named president and chairman of the board of Willys-Overland, Inc. At the same time, **Charles E. Sorenson,** president of Willys since 1944, was named vice chairman of the board.

G. D. Moomaw, vice president and general manager of the Rustless Iron and Steel Corp. before its merger with the American Rolling Mill Co., has been appointed general manager of the Rustless division.

Malcolm S. Clark, president of Federal Machine & Welder Co., Warren, Ohio, has also been made president of Federal's recently acquired subsidiary, Sommer & Adams, Cleveland. **Victor Pruca** remains as Sommer's vice president in charge of production.

Albert W. Lavers has been named chief engineer of Graham-Paige's farm equipment division at Willow Run.

J. R. Ferguson has been appointed director of automotive engineering of the Packard Motor Car. Co., Detroit.

C. Fred Watkins has joined the American Swiss File and Tool Co., Elizabeth, N. J., as traveling factory representative.

Fred Albrecht treasurer and director of The Lodge & Shipley Machine Tool Co., Cincinnati, retired from active duty on December 31. Mr. Albrecht has been with the firm since 1906 and knew the late founders of the business, William Lodge and Murray Shipley. He had served as advertising manager, office manager and sales manager before being appointed treasurer and director in 1928. During his long career with Lodge & Shipley, he became well known in the industry and was active in representing the company at National Machine Tool Builders Association meetings.

W. M. Walworth has been elected vice president and chief engineer of the Mack Manufacturing Corp., New York City. He joined Mack in 1939 and has been acting chief engineer since last March.

C. W. Johnson

C. Wheeler Johnson, newly elected vice president of Continental Motors Corp., Detroit, has been placed in charge of a new general service and distributor sales department for the concern. Mr. Johnson has been with Continental for a year, following 17 years with the Oliver Corp., where for six years he served as manager of its Battle Creek plant.

B. C. Colcord, who has been assistant vice president in charge of operations in Pittsburgh, has been appointed general superintendent of the Lorain, Ohio works of the National Tube Co.

E. J. Protin has been appointed vice president in charge of a newly created products development research division of the Pittsburgh Steel Co. At the same time, **J. H. Morrison,** who rejoined the company last October as general works manager, was named vice president in charge of operations, succeeding Mr. Protin.

J. W. Brauns has been appointed to succeed **F. H. Craton** as manager of General Electric's Industrial Haulage Div.

Clarence L. Smith has been appointed Detroit district manager for the Grinding Machine Div., Norton Co., Worcester, Mass. He succeeds **Oscar A. Knight,** who is retiring after 40 years with the firm. **Henry A. Blackburn** has been appointed refractories engineer for the Pacific coast and is succeeded in his former territory of Ohio, Mich. and Ky. by **Louis S. Weber, Jr. George D. Seguin** has been appointed purchasing agent succeeding **Marcus W. White,** who has retired after more than 38 years with the firm.

Clarence L. Smith

Oscar A. Knight

G. A. Huggins, formerly chief of tooling for all Douglas Aircraft plants and recently plant manager of the Long Beach factory, has been named manager of the company's Santa Monica plant, succeeding **H. E. Guerin,** who recently retired after 25 years with Douglas.

Dr. Stewart G. Fletcher has been named chief research metallurgist by Latrobe Electric Steel Co., with headquarters at Latrobe, Pa.

Carl M. Heller has been appointed sales representative of the Corbin Screw Div., American Hardware Co. in eastern Mass., R. I., Me., N. H., and Vt. At the same time, **Raymond M. Maloney** was named New England sales representative for the solicitation of contact jobs for screw machine products.

Thomas C. Ford has been appointed Pittsburgh district manager of the Electro Metallurgical Sales Corp.

E. A. Taylor has joined Allied Control Co. as general sales manager.

Herbert Johnson

John B. Mitchell

John B. Mitchell, for the past eight years superintendent of the Pittsburgh rolling mills, has been appointed assistant to the operating vice president of Jones & Laughlin Steel Corp. **Herbert Johnson** has, at the same time, been appointed assistant to the vice president in charge of sales.

John H. Sipchen has been appointed to represent the Erie Foundry Co., Erie, Pa. in Chicago. Mr. Sipchen, who succeeds the late **L. F. Carlton,** will maintain headquarters at 549 W. Washington Blvd.

James C. Barnaby, consulting engineer of the Worthington Pump and Machinery Corp., has been transferred to the general engineering staff at the Harrison Works as assistant director of research and development.

Kenneth S. Witt, formerly assistant works manager and director of standards at Willys-Overland Motors, Inc., has been named factory manager of the Sealed Power Corp., Muskegon, Mich.

E. J. Hunt has been appointed manager of operations for Kaiser-Frazer Corporation's Willow Run plant. Mr. Hunt was operating manager of the Chrysler Tank Arsenal during the war.

Charles E. Schutte has been named assistant chief engineer of the body division of Willys-Overland.

E. J. Wedge has been made superintendent of the Ford Motor Company's Highland Park plant, while **Harold Robinson** is now general superintendent of tractor manufacturing and assembly.

C. Q. Wright, who was recalled to active duty with the Navy shortly after Pearl Harbor, has returned to the Whiting Corp., Harvey, Ill., as vice president.

V. B. Bergenthal, treasurer and director of the Wagner Electric Co. since 1922, has retired, but will continue in his capacity as a director. He has been with Wagner for 41 years as assistant sales manager, purchasing agent, treasurer and director.

BUSINESS ITEMS

Northrop Aircraft, Inc., Hawthorne, Calif., has acquired **Salsbury Motors, Inc.,** 4465 District Blvd., Los Angeles.

The U. S. Air Compressor Co., 5300 Harvard Ave., Cleveland, has purchased the building at that address, which it previously leased. Additions are planned in the near future.

Progressive Welder Co., Detroit, is doubling its plant floor space with the building of a factory adjacent to its present one and a structure joining the two buildings.

The New York Car Wheel Co., Buffalo, plans a $400,000 modernization program during 1946 in which the interior of the plant will be practically rebuilt. Machining operations will be moved into the main plant from another Buffalo location to provide more compact plant facilities.

Trico Products Corp., Buffalo, N. Y. has purchased the **Ford Motor Co.** assembly plant there to expand its production. Improvements are under way and machinery has been installed.

Charles E. Moore, head of **Joshua Hendy Iron Works,** Sunnyvale, Calif., has sold his stock interest in the company to the **California Ship Building Corp.,** giving the latter concern control of the iron works.

The Superior Type Co., Chicago, has changed its name to **Superior Marking Equipment Co.**

Philadelphia Gear Works has appointed **Leroy L. Handy,** 6932 Cass Ave., Detroit to represent the firm in the Detroit area. The **Atwood Machinery Co.,** 931 Santa Fe Ave., Los Angeles will represent them in southern Calif. on everything except Limitorque valve controls.

U. S. Textile Machine Co. has moved its plant to larger quarters at 411 Gillian St., Scranton, Pa.

Dravo Corp., Pittsburgh, has formed a new sales department known as the **Gear and Transmission Section of the Machinery Div.** Headed by **Henry E. Rea,** the new office will be in the Dravo Bldg., 300 Penn Ave., Pittsburgh.

The National Broach & Machine Co., Wilbraham, Mass., has appointed **Richard S. Brown** as its exclusive agent in New England, except Conn.

Staples Tool and Engineering Co., Cincinnati, has changed its name to **The Staples Tool Co.**

Philco Radio & Television Corp., wholly-owned subsidiary of the **Philco Corp.,** Philadelphia, Pa., has changed its name to **Philco Products, Inc.**

The **Murray Tube Works** has been formed as an affiliate of the **A. B. Murray Co., Inc.,** to engage in the custom fabrication of tubular steel. The new concern is located at Green Lane, Elizabeth, N. J.

OBITUARIES

George Bridges, 58, pump application engineer and an employee for 40 years of the Worthington Pump and Machinery Corp., Harrison, N. J., died Dec. 19.

Gilbert L. Haines, 51, president of the Haines Tool Co., Cleveland, which he founded over 30 years ago, died Dec. 29. A process used by the company for reclaiming high-speed cutting tools was perfected by him.

Henry Kohnle, 81, former president of the Superior Casting Co., Dayton, died Dec. 30 after a short illness. He had been associated with the foundry business for 60 years.

John Doughton, 69, for many years office superintendent of the Buffalo Foundry & Machine Co., Buffalo, N. Y. passed away recently.

MEETINGS

American Society for Metals. Annual Convention. Statler Hotel, Cleveland, Ohio. Feb. 4-8. W. H. Eisenman, managing director, 7301 Euclid Ave., Cleveland 3, Ohio.

American Society for Testing Materials. Spring Meeting. Pittsburgh, Pa. Feb. 25-March 1. C. L. Warwick, secretary, 260 So. Broad St., Philadelphia 2, Pa.

American Society of Tool Engineers. New Era Exposition. Cleveland Public Auditorium. Cleveland, Ohio. April 8-12. C. V. Briner, president, 1666 Penobscot Bldg., Detroit, Mich.

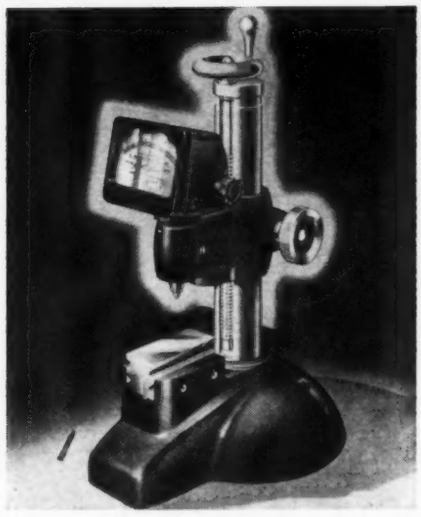
National Metal Congress and National Metal Exposition. Cleveland Public Auditorium. Cleveland, Ohio. Feb. 4-8. W. H. Eisenman, managing director, 7301 Euclid Ave., Cleveland 3, Ohio.

CANCELLED — American Welding Society. National Meeting. Hotel Cleveland, Cleveland, Ohio. Feb. 4-7. National Headquarters, 29 W. 39 St., New York, N. Y.

Shop Equipment News

Units here shown have not been described previously in our pages and are being exhibited for the first time at the National Metal Show in Cleveland, Feb. 4-8, 1946

The Jack & Heintz electronic comparator for surface and height gaging employs lightweight high-frequency magnetic coils in the gaging head to actuate the separate electronic gage indicator. Losses from heat differentials are eliminated by remote positions of heat-producing units



Model AC electronic comparator is intended for precise external measuring. The gaging head of the electronic indicator can be removed from the comparator stand for use with other fixtures. It is also used as a separate indicator, the gaging head being independent of the comparator stand

Jack & Heintz Electronic Gages Provide Speed and Precision

Electronic gages designed for gaging mass-production work with high precision are manufactured by Jack & Heintz, Inc., Cleveland 1, Ohio. The accuracy of electronic measuring equipment when used by inexperienced workmen is an advantage claimed for the electronic measuring gages of this line. The gages employ only high-frequency alternating current for their operation, which makes possible the use of lightweight electromagnetic coils in the gage head. Electronic tubes provide the means of generating and amplifying the small amount of high-frequency current required.

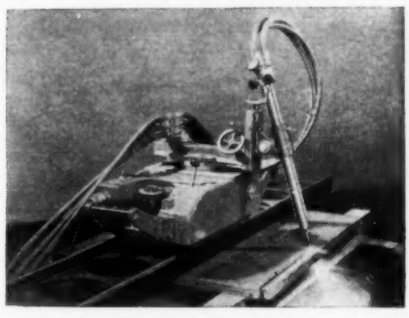
Other advantages claimed for these gages include small-size gaging head, which enables work to be measured in confined areas; no errors due to temperature changes, as the heat loss in the gaging head is negligible, no warming-up errors, because the heat-producing units of the system are all located in the power unit, which is separate from the actual gaging fixtures; and correct electrical balance which makes the accuracy of the system independent of line-voltage fluctuations.

The electronic gaging principle is adaptable to special fixtures for precision production inspection, gaging parts for selective assembly, and other applications requiring measuring instruments having graduations from 0.0001 to 0.00001 in. or 0.000005 in.

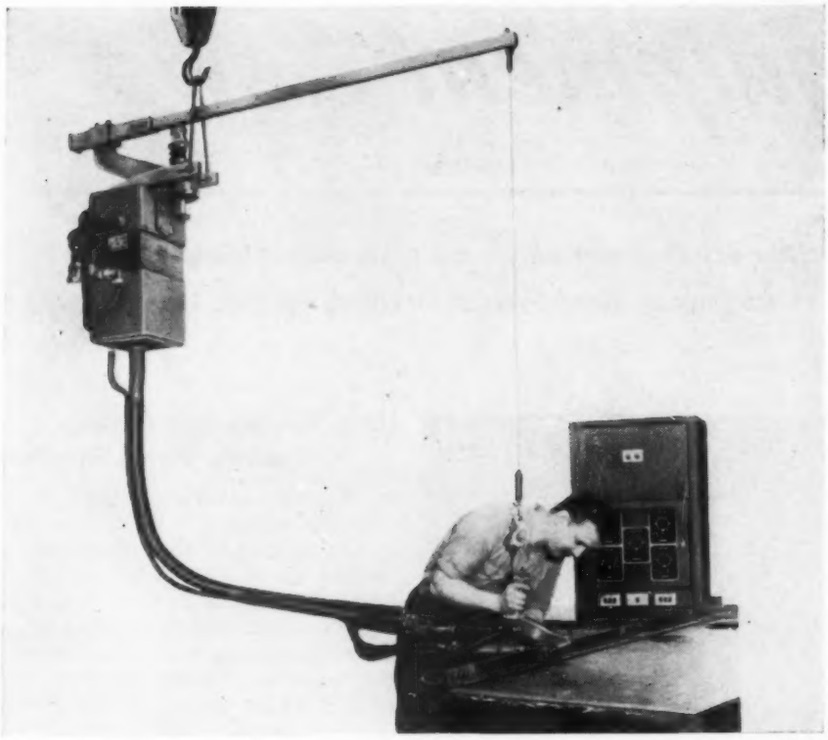
Linde Welding Unit Carriage Operates Varied Equipment

A heavy-duty, straight-line welding machine carriage, CM-37, has been developed by Linde Air Products Co., 30 E. 42nd St., New York 17, N. Y. This carriage can be used for carrying Unionmelt electric welding equipment, the CMA-21-B attachment for plate-edge preparation, single- or multiple blowpipe setups for straight-line cutting, flame-hardening equipment, and the Oxweld C-45 blowpipe for cutting extra heavy sections. Its weight, without equipment, is 87 lb.

The carriage is 32 in. long, 12½ in. wide, and 9 in. high, plus an additional 2⅞ in. for the control lever. It is equipped with a 110 volt ¼-hp. a.c. motor. Reversing is accomplished mechanically through gears. The carriages are supplied with speed ranges of 2 to 50 in. per min. for general industrial use, and 7 to 210 in. per min. for use with the Unionmelt welding process. An electrical speedometer indicates the welding speed. When accuracy of travel is not important, the carriage can be operated on a standard 10-in. 25.4-lb. I-beam. It also can be operated directly on steel plate or other flat work.



Linde CM-37 straight-line welding machine carriage is constructed of aluminum alloy castings to hold total weight to 87 lb. Low weight allows its use on light or overhanging sections already in place



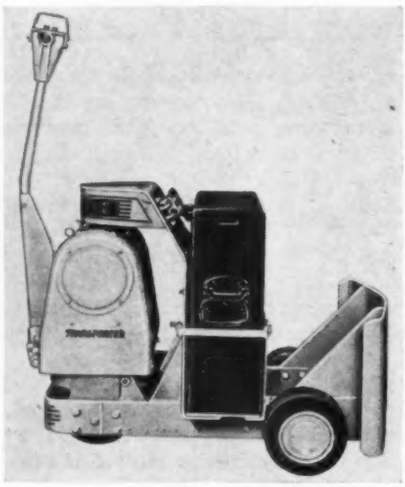
The spring or pneumatic balancer used with the Sciaky portable spot welder holds all weight of the gun and assists maneuvering to position

Sciaky Portable Spot-Welders Provide High Pressure at Gun

A line of overhead type portable spot-welding units has been announced by Sciaky Bros., 4915 W. 67th St., Chicago, Ill. Both pneumatic and hydraulic systems are available with transformer rating of 50, 75, and 100 KVA. The equipment includes several lightweight guns in alligator and C types. Spring type or pneumatic balancers are provided for positioning the gun. Tranformers may be had with or without tap switch. Electronic control units are available for control of welding sequence, current interruption, and welding heat. The hydraulic system is equipped with a fast-acting booster and electro-valve. In case of leakage, the system is automatically refilled from the line supplying cooling water to the transformer, cables, and gun. Corrosion-resistant materials are used throughout.

Transtractor Provides Power For Manually Operated Trucks

Automatic Transportation Co., 101 W. 87 St., Chicago 20, Ill., manufactures the Transtractor, a power unit for pushing or pulling unpowered platform or pallet trucks. The front-wheel drive furnishes maneuverability in close quarters. The forward and reverse drive controls are push-button operated from the guide handle. Raising and lowering of the guide handle controls two forward and two reverse speeds. Drive brakes are applied with the return of the guide handle to an upright position. The steering turntable is ball-bearing mounted. The front-wheel drive has a double-reduction chain drive from a series-type motor.



Normal drawbar pull of the Transtractor is 100 lb., ultimate is 350 lb.

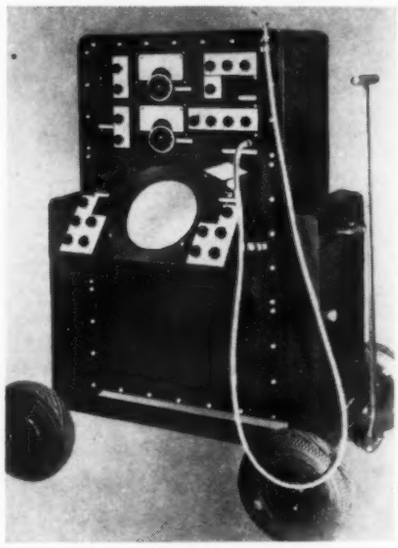
Reflectoscope Uses Intermolecular Vibration for Physical Testing

Sperry Products, Inc., 15 & Willow Aves., Hoboken, N. J., manufactures a non-destructive test device for locating internal defects in mechanical parts. The Supersonic Reflectoscope sends vibrations through material under test and measures the length of time it takes these vibrations to penetrate the material; reflect from the opposite side, or an internal defect, and return to the sending point. The pattern produced on an oscilloscope screen provides a visual indication of the location of any defects that may be present in the material which is under test.

A quartz crystal mounted in a searching unit is applied to the surface of the material under test. As it is moved over the surface the vibrations travel through the material and are reflected back from the other side, or from any defects in the path of the vibrations. If the defect is small, only part of the vibrations will be reflected back from the opposite side. Large defects such as voids or cracks may, if large enough, reflect all vibrations so that none pass to the other side.

Visual indications of the reflected vibrations are viewed on the oscilloscope screen.

Access to the part tested is necessary only from one side. Depth of penetration may be up to 10 ft. if required.



The Sperry Reflectoscope is self-contained, mounted on a rubber-tired carriage and may be transported as necessary

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ENGINE LATHES You can't beat these Engine Lathes for general utility on single piece jobs. They're built with extra rigidity, take heavy hogging cuts without vibration. As a result, you can demand more from these lathes and get it—in much less time. Write on your company letterhead for detailed literature No. 500, 503, 605.

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MANUFACTURING LATHES give you remarkable time savings on repetitive work in large or small lots. Manufacturing attachments form a profitable production unit. These permit multiple tooling and easy, rapid duplication of lengths and diameters. An L & S Manufacturing Lathe need never be idle—it's an engine lathe for single piece jobs, rivals an automatic on production work. Write for detailed literature No. 608, 615

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2A OR 3A DUOMATICS are fully automatic, even on complex multiple tool jobs. So easy, any unskilled operator can handle one or more of these lathes. You just put in the workpiece, start the cycle, take the piece out when finished. It's like two lathes in one, with front and rear carriages and tool slides, operated singly or together. A Duomatic turns thousands of pieces with amazing savings in time and effort. The 2A is for small jobs, the 3A for larger work. Write for detailed literature No. 601 and 620.

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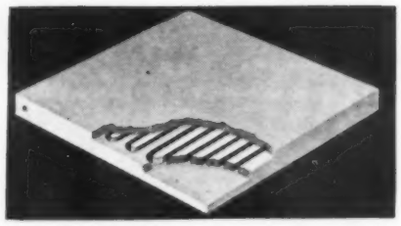


Internal labyrinth in the Lukenweld steam platen evenly distributes heat over the full area of the platen

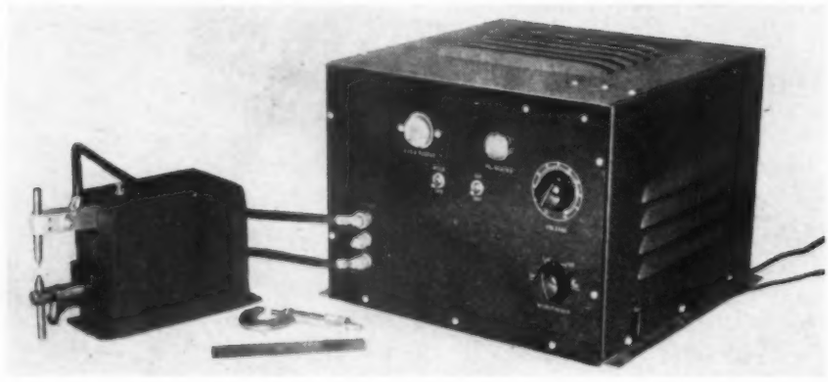
Lukenweld Steam Labyrinth Platen Heats Laminates Evenly

Lukenweld, Inc., 1943 Gillen St., Coatsville, Pa., is the manufacturer of a weld-assembled steam platen for hot-bed press operations. Platens can be made in sizes for all presses.

Raytheon Welder is Suited For Thermally Conductive Metals

Raytheon Manufacturing Co., Foundry Ave., Waltham, Mass., manufactures a condenser-type welding unit which provides a 3-amp. peak with 110-volt 60-cycle current. The unit is suitable for welding metals of high thermal conductivity such as aluminum, copper and phosphor bronze, which require precision weld methods.

The welding head is foot-operated. Control of output is obtained by means of two knobs which provide adjustments of power over ranges to fit the weld requirements. The allowable speed ranges from 120 welds per minute at low voltage and capacity setting, to 60 welds per minute at peak performance setting. Both the power supply and control unit for small welding heads are assembled in a ventilated steel case. All controls are located on the front panel, exclusive of foot control.



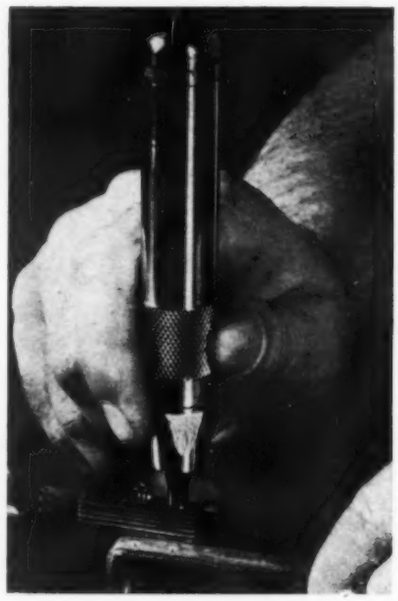
Energy for welding with the Raytheon unit is accumulated in a heavy-duty condenser which discharges when the control is pressed

Aro Pneumatic Screw Driver Increases Assembly Speeds

The Midget pneumatic screw driver, Model 7000, manufactured by Aro Equipment Corp., Bryan, Ohio, is designed especially for driving small screws. Its capacity includes screws from No. 1 to No. 6. It weighs 8 oz. and is 4 7/8 in. long and ¾ in. in diameter.

It is fully automatic with no manual throttle. It starts automatically when applied to the work.

It has a rotary type motor, 4-blade construction, ball bearings throughout, and a hardened-steel rotor and cylinder. The tool is available with adapter socket for nut setting. Finder and bits are easily interchanged for various-size screws. Tool is chrome finished.



Oakite Vapor Cleaning Unit Generates Steam for Cleaning

A multiple-duty steam-cleaning unit designed for cleaning of machines, parts, container and other products has been developed by Oakite Products, Inc., 26 Thames St., New York 6, N. Y. The Oakite-Vapor cleaning unit consists of an oil-fired steam generator, which delivers vaporized cleaning solutions under pressures up to 200 for removing grease, grit, paint, and other deposits from surfaces. The unit can be operated on No. 1, 2, or 3 fuel oil, kerosene, or gasoline.

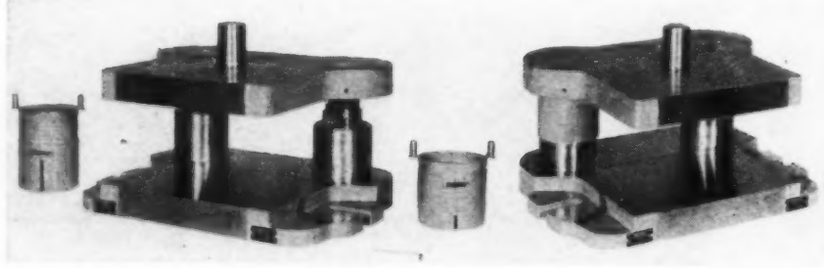
Lempco Die Set Eliminates Jamming with Roller Guides

Lempco Products, Inc., Dunham Rd., Bedford, Ohio, produce an anti-friction die set with preloaded ball or roller bearings incorporated between the guide pins and the punch holder guide bushings.

All surfaces are precision ground to assure perfect parallels. The punch holder and die holder are matched, clamped and are jig bored in the same operation to insure alignment of the guide pins.

The guide pins are hardened and ground and are made of wear-resisting alloy steel.

An original preload of 0.0015 in. is set up in both the ball and roller bearing die sets. After a run of 18,000,000 strokes, a careful inspection shows remaining preload of 0.0005 in.



Lempco anti-friction die sets can be opened and closed by hand without the aid of pry bars or pullers

TAPS WITH DRILL OR REAMING SECTIONS
LONG TAPS AND SHORT TAPS
TAPS WITH SHORT OR LONG CHAMFER
STEPPED TAPS AND STRAIGHT TAPS
LARGE TAPS AND SMALL TAPS
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ALL KINDS OF TAPERED TAPS
• GROUND TAPS • THREAD MILLING CUTTERS • THREAD GAGES & SPECIAL THREADING TOOLS, MACHINES AND CHECKERS •
You can recondition all these taps ON A DETROIT
TAP RECONDITIONER
Having one of these DETROIT 4 in 1 tap reconditioners in your shop is just like getting an almost unlimited supply of NEW TAPS for next to nothing. With this simple low cost machine you can quickly put your worn taps back in first class condition. The machine will chamfer the taps, grind from 2 to 6 flutes, spiral point them where required and polish the points. Pays for itself in a remarkably short time. Write today for complete descriptive Bulletin #DTR-2.
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Copper-Cushioned Toolbits Processed for High Metal Removal

General Tool & Die Company, 555 Prospect St., East Orange, N. J., is demonstrating Cushioned toolbits which remove several cu. in. per min. of metal per horsepower. These toolbits are made from high-speed steels, but special processing and tool shapes are used. The maker asserts Cushioned tools will remove metal at maximum rates, and that they will withstand jump cuts on alloys steels and avoid creation of a glaze finish, or skin, because of the positive rake angle employed.

Several demonstrations of Cushioned toolbits were carried out on an old vertical miller driven by a 10-hp. motor. The face mill, like that

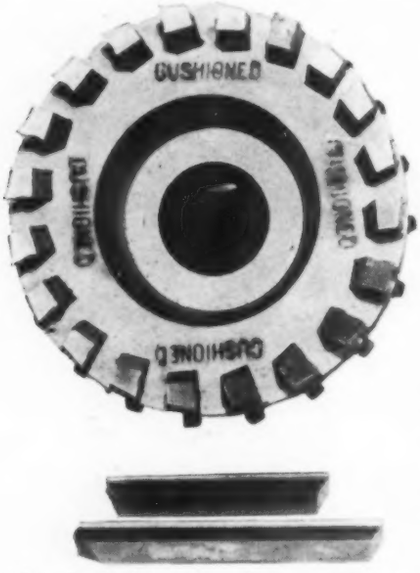

Fig. 1—Cushioned toolbits are set into a face mill with tapered body

shown in Fig. 1, had twenty ⅜-in. toolbits set into a slotted body, each toolbit extending ¾ in. from the body and held in its slot by only two small setscrews. Some of the tests witnessed were:

Max-L alloy steel (similar to SAE 4150)—table travel, 100 in. per min.; depth of cut, 3/32 in.; cutter speed, 81 rpm.; cutting speed, 125 sfpm.; chip thickness, 0.062 in., condition of chip, bright. This was an extreme case undertaken to show the chip load the cutter teeth would withstand, plus the impact when rapid-traversing the cutter into the work at 100 in. per min.

Meehanite iron—table travel, 160 in. per min.; depth of cut, 3/32 in.; cutter speed, 143 rpm., cutting speed, 223 sfpm.; chip per tooth, 0.056 in. Approximately 4 cu. in. per min. of metal were removed per rated motor hp.

In these tests, cuts were made with very little noise. There was no pronounced bump when the cutter struck the work, and the machine did not "grunt."

Toolbits have been processed in a manner such that maximum hardness is obtained at the cutting edge, while the metal in the body of the tool has maximum toughness and impact resistance.

As shown in Fig. 2, a copper cushion 1/32 to 1/16 in. thick is brazed to the bottom of the toolbit. This cushion helps to absorb shock on the cutting edge, and minimizes the possibility of the tool shifting in the holder. Further, toolbits are ground in the annealed state, then tumbled before

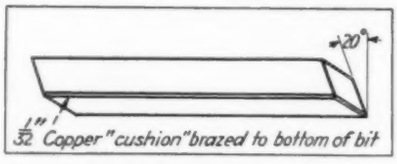

Fig. 2—By controlling the brazing, a hardness gradient is obtained

hardening. By removing sharp edges and tool marks, the chances of warping and cracking in heat-treatment are minimized. The steel is heated to its maximum hardening temperature to develop full hardness. And in the brazing process, controls have been established so the upper third of the toolbit is left at maximum hardness, while the lower two-thirds are drawn back to a hardness gradient. Laboratory tests indicate the Izod impact-resistance of cushioned tools is at least twice that of conventional high-speed steel tools.

Two kinds of high-speed steel are used: 12% cobalt and a special high carbon, high-vanadium steel. The first is copper-plated and the second cadmium-plated for identification. By the special control of the hardness gradient, the 12% cobalt tools are currently manufactured to a hardness of Rockwell 65-68 C near the cutting edge and about 50 at the cushion. Soon commercial toolbits will be manufactured to a Rockwell hardness of 67-70 C at the cutting zone. The 12% cobalt tools are offered for work requiring maximum red hardness, that is, those that generate heat. The high-carbon,

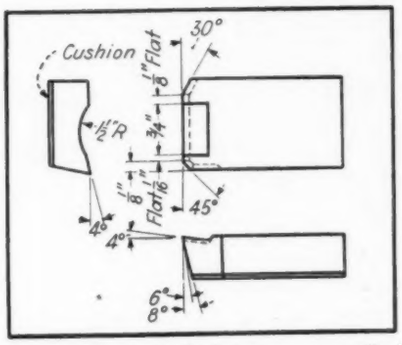

Fig. 3—Even chilled iron was milled with this early form of blade

high-vanadium toolbits likewise have a hardness of Rockwell 50 C near the cushion, but a hardness in the upper third of 67-70 C, and the early probability of 68-71.

These toolbits can be ground with conventional grinding wheels.

General Tool & Die will make cushioned tools only—toolbits, planer and shaper tools, form tools and toolbits or cutter blades for insertion in milling cutters by licensed manufacturers of cutters. Turning tools will be supplied with or without a honed longitudinal groove in the top face. The groove is desirable on turning tools for best finish, and is integral in cutter blades.

Tool angles are still under development. In an early cutter blade, Fig. 3, roughing was done on the 45° chamfer and finishing by the ¾-in. hollow-ground edge. With this blade it was found possible to mill a variety of materials, including chilled iron. On 4150 steel of 250 Brinell it was possible to get a satin finish when taking a ⅛-in. cut at a feed rate of 36 in. per min., using a 6-in. six-blade cutter operating at 200 sfpm. and taking a chip of 0.045 in.

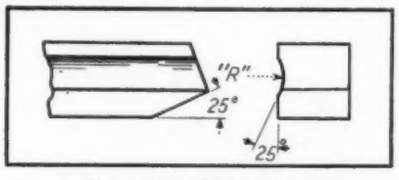

Fig. 4—This style of blade is now used in latest milling cutters

The latest development in cutter blades is shown in Fig. 4. Here a ¼-in. radius is ground in the top face of the blade. This construction creates a severe shear angle two ways at the bottom of the tooth. A 5° rake is used. Roughing is done by the nose of the tool, finishing by a portion of the half-moon created in the face by the hollow-ground radius. The shear angle, in this case 25°, is controlled by the radius of the groove.

"I've run tests and I Know... These are the Sharpest Cost-Cutting Tools that any shop can use!"

Comparative tests of American Phillips Screws with any other type prove: *American Phillips Screws always cost less to use.* Here are some of the reasons:

Easier Handling: 4-winged driver fits firm and straight into tapered recess in screw-head . . . can't twist out. Spiral and power drivers are safe to use on all jobs. No fumbling, false starts or dropped screws.

Fast, Straight Driving: Screw and driver align automatically into one straight driving unit. Starting is faster. Driving is easier. And screws are turned up tight and flush the *first* time, *every* time.

Cleaner Fastenings . . . Unmarred Work: No crookedly driven screws, no split or burred screw heads. And because the driver can't twist out, there are no slashes on work-surfaces, no injuries to workers.

IN SUM: American Phillips Screws save an average of 50% in assembly time.

Today, with assembly costs increased and threatening to go higher, the time saved through the use of American Phillips Screws becomes doubly important. And you get a further saving, too, from American's 4-phase inspection, which gives you a higher "perfection-percentage" in every order for *American* Phillips Screws and Bolts. So start action today, to cut costs the American way.

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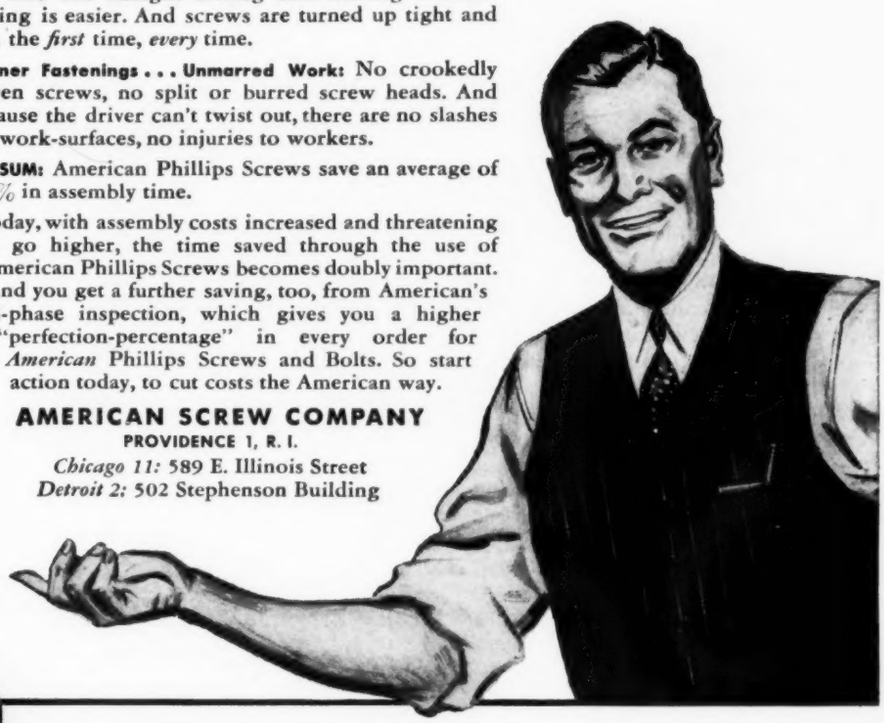

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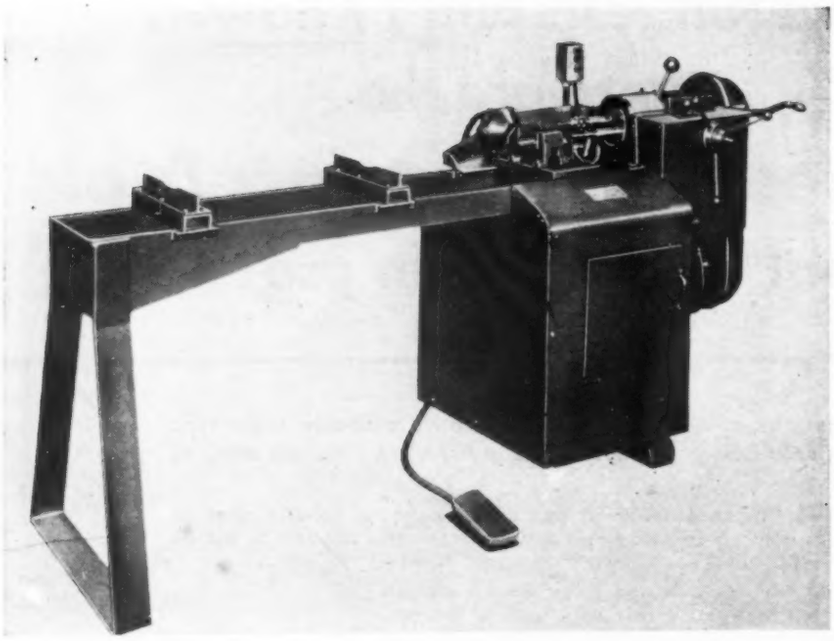


Cleveland Tapping Machine End-Taps Long Workpieces

The Cleveland Tapping Machine Co., 3610 Superior Ave., Cleveland, Ohio, produces a horizontal combination drilling and tapping machine for drilling and tapping of pieces up to 96 in. long with one handling. The work piece is loaded against a stop then automatically clamped in position and not moved until drilled and tapped. With the method of drilling then indexing to tapping position and tapping the work piece to proper depth, the possibility of misalignment is eliminated. Each spindle can be independently adjusted for depth of travel and each spindle can be held to within 0.010 in. horizontal travel. All spindles are equipped with ball bearings. The machine has five speeds and can drill and tap from ⅛ to ½ in. N. C. in steel. The tapping spindle revolves at 60% of the speed of the drilling spindle.

Tatra Lapping Plates Suited For Diamond or Wet Charges

Tatra Tool Co., 16317 Sanford Ave., Cleveland, Ohio, manufactures Super-Speed lapping plates with diamond or square charge patterns. The plates are suitable for diamond-charged and wet-lapping operations. Both patterns are fitted with bands.

Surface tolerance is held to 0.0005 in. and the plate is supplied with a padded case to prevent accidental damage. Twelve tapped holes are provided for position of handles.

Super-Speed lapping plates are aged to minimze warping

Viculoy Beryllium Copper Alloys Have Varied Characteristics

Akron Bronze & Aluminum Co., 579 Washington St., Akron, Ohio, manufactures three types of Viculoy beryllium copper. No. 1 has an ultimate tensile strength of 85,000-90,000 psi., 94-96 Rockwell B, and an electrical conductivity of 50-55. When exposed to high temperatures, No. 1 shows a lower strength loss than usual nonferrous alloys.

No. 2 is a hardened alloy with an ultimate tensile strength of 45,000-50,000 psi. Its resistance to corrosion, electrical conductivity of 65-70, and hardness of 70-78 Rockwell B, are suited to applications in welding equipment.

No. 3-1 is an heat-treatable alloy suited for castings subjected to high impact loads, high pressures, high speeds and exceptional stresses. Ultimate strength is 160,000-170,000 psi. Hardness is 38-42 Rockwell C and the material may be used in gears, dies, non-sparking tools and other mechanical parts.

Fluxrite Flux-Filled Solder Feeds Flux Before Solder

National Lead Co., 111 Broadway, New York, N. Y., produces a fluxed wire solder that contains the flux in four closed helical grooves. This method of containing the flux assures that the flux will melt and deposit on the work before the solder melts. The four cores of flux eliminate skips or gaps and a continuous flow of flux is assured during soldering operations. Fluxrite is available in regular wire solder gages and may be obtained in ring or other special shapes.

Anaconda Welding Rod Develops Strength Without Peening

American Brass Co., Waterbury 88, Conn., manufactures a rod intended for oxyacetylene welding of deoxidized copper. The weld produced with Anaconda No. 372 is almost pure copper. Full strength of the annealed plate is developed without peening or other cold working.

Rustless Electrolyte Provides Flexible Electropolishing

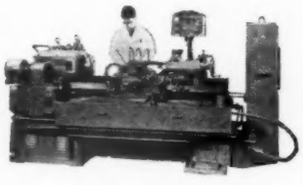
Rustless Iron & Steel Div., American Rolling Mill Co., 3400 E. Chase St., Baltimore, Md., is the licensor of U. S. Patent 2,335,354, a solution suitable for the polishing of stainless steels by electrolytic methods. The stainless-steel parts to be polished are suspended in the electrolyte and anodically treated at low amperage. Treatment produces a bright surface finish, removes scale and discoloration and inhibits corrosion.

Ampco Cast Welding Wheels Maintain High Conductivity

Ampco Metal, Inc., 1745 38th St., Milwaukee 4, Wis., produces seam-welding wheels for all types of roller seam-welding machines. Alloys used have high electrical-conductivity characteristics. The blanks are cast by static or centrifugal casting methods and supplied fully machined or as rough forgings.

"I don't look any further after I've found a Monarch"

Monarch Model NN
Turning Machine



Monarch Magna-Matic
Turning Machine

Monarch 10" Sensitive Precision
Toolmaker's Lathe

Speaking of buying turning machines from government surplus stocks, the production engineer of one of the nation's largest industrial plants said:

"I don't look any further after I've found a Monarch."

This points out the reason why so few Monarch turning machines are listed for government disposal or in the used machine tool markets. Either they're held by their owners . . . or the few that do appear are quickly snapped up by discriminating buyers.

The reason is obvious—Monarchs pay their way! In finer machining, closer tolerances, faster production with less operator fatigue, Monarchs have always paid outstanding dividends to their owners.

For your postwar production, standardize on Monarch. If our delivery schedules can't meet your requirements, we'll help you select Monarchs whenever they may be found in government surplus stocks. Call on our nearest office for any turning machine requirement.

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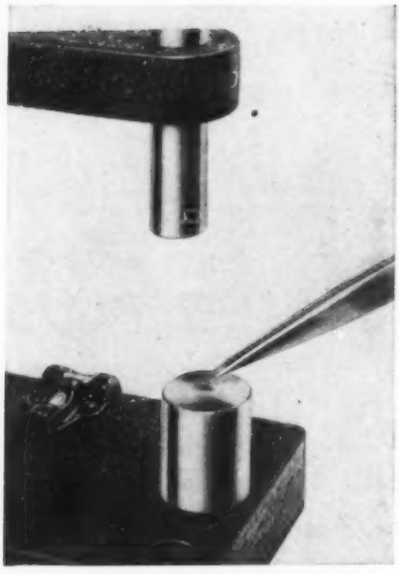
Monarch
TURNING MACHINES



The operation of the G. E. magnetic hardness tester is based upon the correlation of hardness and coercive force in magnetic materials. It checks pieces of unknown hardness against a specimen of known hardness by comparing the relative strength of the magnetism produced in the test pieces and in the standard specimen under the same conditions of magnetization. This test will distinguish differences as little as two points on the Rockwell C scale, and does not damage the piece tested

G. E. Magnetic Hardness Tester Tests Parts Non-destructively

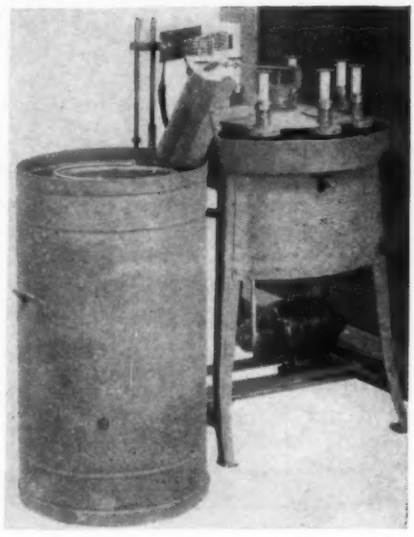
A magnetic hardness tester for rapid gaging of hardness of small, ferrous parts has been announced by General Electric, West Lynn, Mass. The tester simplifies inspection of such parts as electric-instrument pivots and shafts, watch shafts, small steel balls, and others too small to be production-tested with mechanical-type hardness testers. It permits spot checking of hardness in large sheets, or lengths of steel wire, through the comparison of random-selected samples.

The tester, 6 in. long, 3½ in. wide, and 7 in. high, consists of an alnico bar magnet set in an adjustable soft-iron frame, which permits the air gap, and thereby the field strength, to be set at the correct value for testing pieces of different size, whose dimensions are between 1/16 and ½ in. A knurled thumbscrew locks the air-gap adjustment, and a brass block for positioning the specimen is mounted on the base of the tester, out of the direct line of the magnetic field. A two-way level is attached to the base to show when the tester is properly positioned.

Rotary Feed Table Increases Induction Heater Output

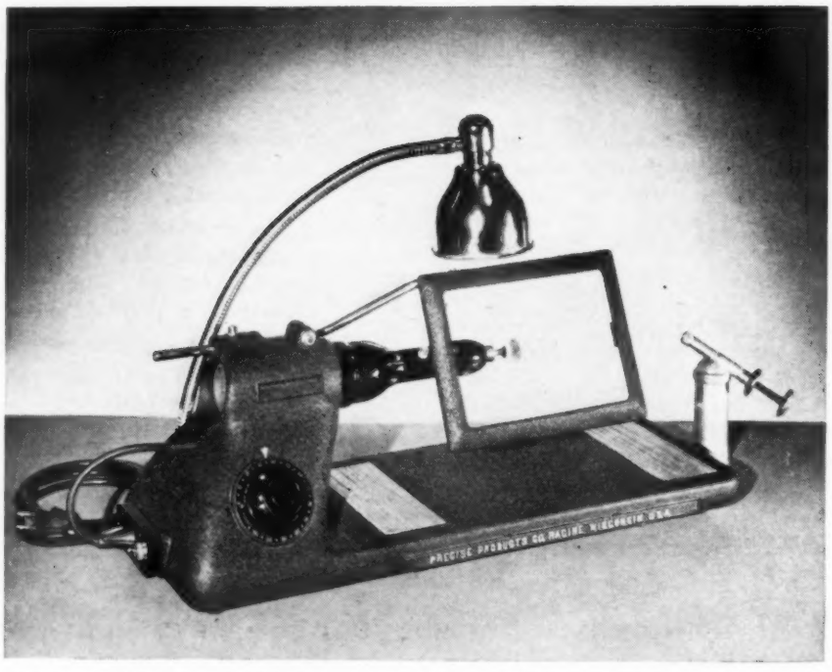
Scientific Electric Div. of "S" Corrugated Quench Co., 107-119 Monroe St., Garfield, N. J., manufactures a rotary gear-hardening table with eight carrier positions.

An 18-kw. high frequency induction heating unit operating in conjunction with the 8-position indexing automatic carrier can be adjusted to index at varying times from 4 to 10 sec. depending upon the size of the gear to be hardened. This unit can be manually operated or hopper fed. One operator can feed four hopper-fed units operating on a 4-sec. cycle —which will afford a total production of approximately 30,000 heat-treated gears per 8-hr. day. If the unit is manually fed, it can afford a production of 7200 pieces per 8-hr. day. The unit receives its heating in two installments while passing through the tube coil stations which raise and lower. While the gears are being heated, they can be caused to spin, affording uniformity of heat.



An automatic ejector discharges heated gears directly to a quench tank basket. Rotation of the table is intermittent and adjustable to time cycles

Vari-Speed Polishing Lathe Operates at 35,000 rpm. Speed



Precise Products Co., 1328 Clark St., Racine, Wis., manufactures the Vari-Speed lathe which operates at speeds up to 35,000 rpm. The lathe is built of a solid aluminum casting designed for full rigidity, compactness and to permit maximum access to the operating area beneath the high-speed spindle. As the motor and spindle are integral, the motor can be removed from the casting and used as a hand grinder.

Cut Costs On and Off the Job

Positioning of McCrosky's service proved pin and screw locking device in front of the blade, enables the screw lock to work with, rather than against the cutting thrust,—thus holding the blade securely in the slot, even when in fully extended position,—and without restricting the clearance for chips and lubricant.

Sectional View Showing Bearing Screw and Pin That Hold the Blade Rigidly Against the Reamer Body.

Blades can be released easily, and adjusted uniformly and accurately. This permits them to be reground with a minimum loss of stock, and the reamer returned promptly to service, reducing to a minimum the number of tools required to keep a job in continuous production.

McCrosky reamers are furnished with straight or taper shanks, or in shell design with straight or tapered holes for mounting on hardened arbors. Sizes up to 6" in diameter with High-Speed blades. Larger sizes, or reamers with cobalt, cast alloy or carbide tipped blades on special order. Send for Bulletin 16-A. Gives full details.

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COST CUTTING TOOLS

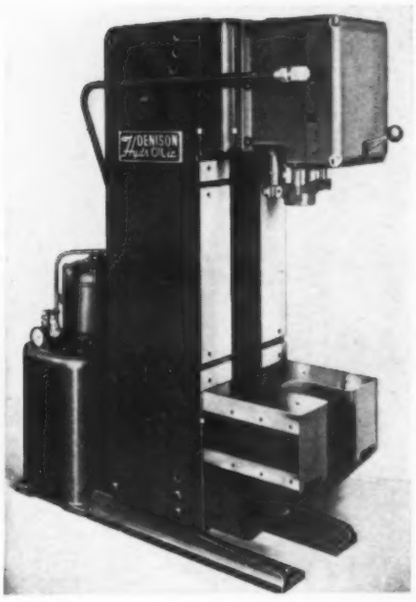
Designers and Manufacturers of

Jack-Lock MILLING CUTTERS — *Block Type* BORING BARS

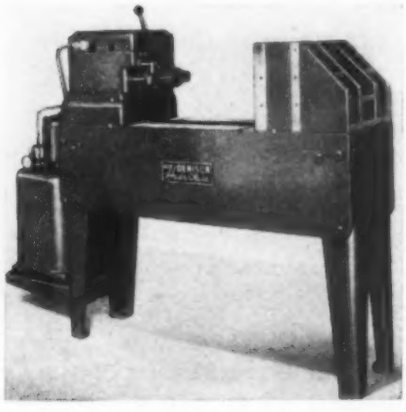
Wizard CHUCKS AND COLLETS

Super Adjustable REAMERS — *Turret* TOOL POSTS

Hydroilic Power Units Varied For Specific Applications



Two assemblies—pumping unit and power head—form the working parts of the Multi-Unit. The pumping unit may be located anywhere adjacent to the power head. It includes electric motor, hydraulic pump, reservoir, pressure regulating valve and is available in 4- and 6-ton capacities



The Denison Engineering Co., Columbus 16, Ohio, is the manufacturer of Hydroilic power units for application to any machine or to a standard frame. It incorporates hydraulic cylinder and ram, control valve, control lever and adjustment devices and is available in five models for various ram action, including manual or automatic control, rapid traverse and regulatable pressing speed, automatically repeated pressure strokes, automatic ram cycling, and vibratory pressure. Ram pressures are closely limitable up to 4 or 6 tons. Ram strokes are regulatable between 1/32 and 6 in.

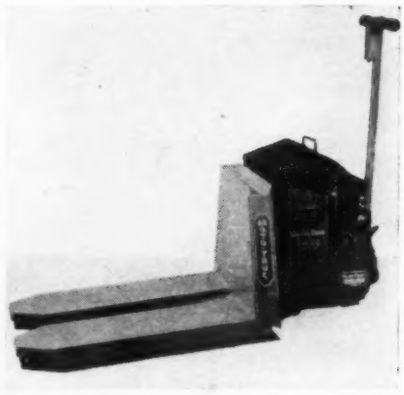
The standard frame may be used in four different positions — horizontally, by using legs which are available in two lengths—vertically, and vertically tilted 10° and 20°, by means of standard feet. Maximum daylight opening when using the standard frame is 24 in.—minimum 12 in. Maximum depth from centerline of ram to frame throat is 8 in. Standard, interlocking accessories, such as indexing tables and ejection cylinders, are applicable to these Multi-Units.

ATC Heat-Treating Controllers Hold Time-Temperature Balance

Either millivolt meter or potentiometer-type pyrometer controllers, as well as any thermocouple element, may be used with the ATC program controller

Automatic Temperature Control Co., Philadelphia 44, Pa., manufactures a stress relief and annealing program controller that will control heat gain or loss and time cycles for variations.

The device is based on a principle of inducing an electromotive force on the usual pyrometer-thermocouple circuit so that rates of temperature increase and decrease may be effected. The controlling operation is reduced to knob adjustments for setting heat rates in degrees per hour and to tab times for maintainence of rates.



Moto-Truc for Pallet Loads Handles 2, 4 or 8 Way Loads

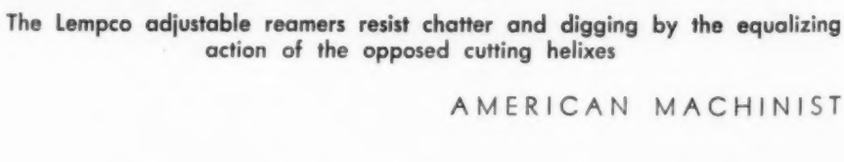
Moto-Truc Co., 6536 Carnegie Ave., Cleveland 3, Ohio, manufactures a pallet truck that will handle 2-, 4-, or 8-way pallets. It can be equipped with a motor-driven pump, to lift the load, and 2-speed control. The truck is equipped with self-centering forks and a roller-type finger-tip handle control. Forks are provided in lengths of 24 to 60 in., in widths of 22 to 27 in.

Lempco Adjustable Reamers Eliminate Digging and Chatter

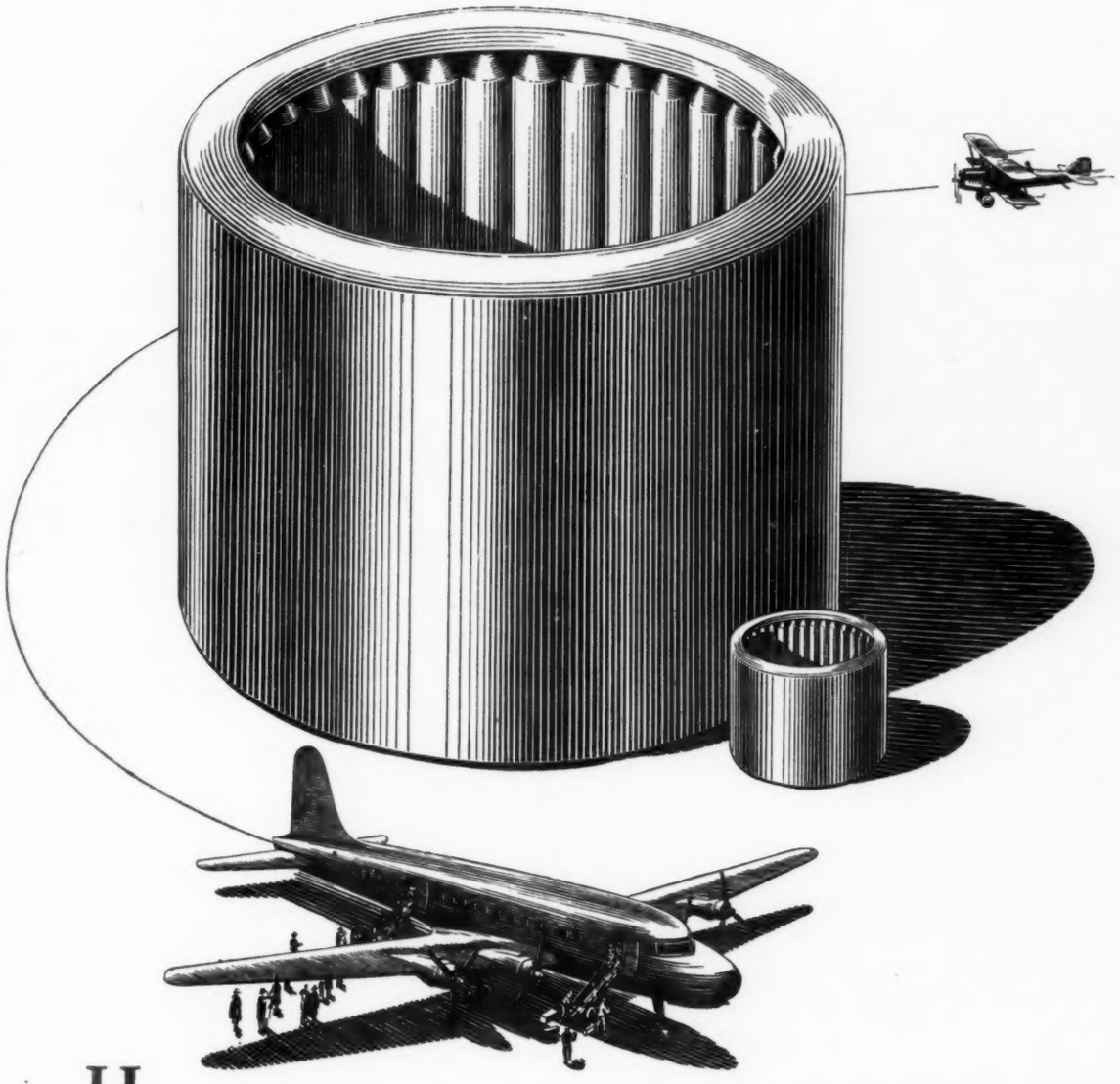
Lempco Products, Inc., Dunham Rd., Bedford, Ohio, manufactures an adjustable helical reamer with opposing helixes at the cutting edge. The alternate right- and left-hand helixes provide a two-way cutting action which produces mirror-like finishes in holes. The helical cutting action permits smooth reaming over such interruptions as keyways and oil grooves.

Each reamer, according to size, has a straightline expansion range of from 0.035 to 0.080 in. The assembly is made up of three high-speed-steel blade segments. Therefore, regardless of the amount of adjustment, a round hole is assured as a result of the threepoint bearing of the segments.

When changing diameters, no additional circular grinding is necessary and a complete blade replacement can be made in 30 seconds.



The Lempco adjustable reamers resist chatter and digging by the equalizing action of the opposed cutting helixes



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That's why the weight-saving, space-conserving features of anti-friction Torrington Needle Bearings are so important. For the full complement of small diameter needle rollers gives a tremendous radial load capacity in an extremely small and compact unit. Furthermore, the bearing is designed for mounting in the simplest type of housing—a bore machined to proper dimensions . . . and installation is a simple press-fit operation.

These features, contributing directly to weight-and-space-saving designs, are enabling many manufacturers to increase the payload* of their products by improving the "*operating efficiency-weight ratio.*"

Let us give you the full story of Needle Bearing advantages in terms of your own design requirements. Considerable engineering and application data are available in the Torrington Needle Bearing Catalog No. 32, furnished upon request. Our engineering department will be glad to work with you on any specific design or application problem.

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Slits or cracks as narrow as 0.001 in. and poor cementing of cycle-welded or similar methods are detected by the Brush Hypersonic Analyzer

Brush Hypersonic Testing Method Detects Flaws at Production Speed

The Brush Development Co., 3311 Perkins Ave., Cleveland, Ohio, has developed a method for non-destructive testing of materials whereby a sound generator sends a supersonic vibration through a specimen. The specimen, depending on its properties, modifies the beam of vibrations and the resulting energy pattern is picked up, on the side opposite the generator, by a microphone. It is possible to select a critical set of frequencies and electro-acoustic designs so the resultant beams through the material are modified by any given type of flaw in any specific material under test.

The method is applicable to materials having a constant cross-section. The material can be examined as it traverses a pair of transducers. Changes for its normal homogeneous condition or physical flaws will change the energy level in the microphone. The change in energy operates a relay which either marks or rejects the flaw or section of material. As the frequency of operation is between 50 and 1000 kilocycles, the relay action is fast and the material can flow through the best unit at high speed.

The Hypersonic method detects flaws associated with two physical properties of the material: an apparent change in density, an apparent change in the modulus of elasticity, or both. As a single reading or relay operation is obtained, the machine does not distinguish which property is changed but indicates that either or both is changed. The fact that the Hypersonic machine is sensitive to changes in modulus of elasticity is advantageous for the examination of material having thin slits or cracks. This type of flaw is one where the change in total mass is negligible, but at the separation junction the effective modulus is small as the material is already separated. The Hypersonic method, which is sensitive to changes in the modulus, will give sensitivity detections of this type of flaw even though the thickness of the slit or crack detected is as small as 0.001 in.

This type of flaw occurs in materials which are rolled in sheets. The stock contains thin laminations which are rolled into long pipes. In this case, the change in total mass is small, but the change in stiffness is great. Better detection is obtained for flaws of this type by the use of sonic methods.

Poor cement joints which occur in cycle-welding and similar processes are detectable with Hypersonic sound beams. Here the actual effectual adhesion is a measure of the modulus or strength of the joint.

Brazing Flux Forms Protective Coating at Temperature of 480 F.

Nu-Braze Wonderflux No. 4, manufactured by Sherman & Co., 197 Canal St., New York 13, N. Y., melts below 480 F. and forms a protective coating before the oxidation temperature of most metals is reached. At 800 F., the flux is water-thin and will flow readily through clearances as small as 0.001 in. It has a pH value of 5-6, and can be painted on parts and allowed to remain for long periods without causing corrosion. After it is melted, it hardens to an extremely brittle glass which can usually be jarred from the brazed part. It is easily removed by either hot or cold water.

After the water content of the flux is driven off at 212° F., there is no further effervescence. This quality is useful where brazing alloys are applied as powders, as the flux will not spatter the powder away from the joint area. Wonderflux No. 4 contains no free fluorides and does not release objectionable volumes of noxious fumes.

Wales Hole-punching Units Will Pierce Heavier Metals

Wales heavy-duty hole punching units, clasified as type BJ, have been developed by the Wales-Strippit Corp., 345 Payne Ave., North Tonawanda, N. Y., for piercing metal up to ¼ in. thick. These units are the first Wales dies with a capacity for punching holes in metal more than ⅛ in. thick. Holder width is increased to ¾ in. diameter.

. . . SEE REVERE AT THE METAL SHOW CLEVELAND, FEBRUARY 4-8

AT the FIRST RECONVERSION SHOW be sure to see the Revere Exhibit. You will find it in Space B-306, the same location in which you found us in the two previous Metal Shows.

Now we are able to point out, openly, definitely and in much more detail than ever before, the amazing advances in metallurgy born of war. In addition we shall re-emphasize the virtues of the more familiar Revere mill products.

Look for exhibits of Revere magnesium and aluminum, of the new specially-prepared switch copper, the new Free-Cutting Copper, the Certified Oxygen-Free High Conductivity Copper, the amazing special finishes available for Radar, and other products of copper, brass and bronze offering great peace-time potentialities.

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Revere Exhibit at the 1944 Metal Show

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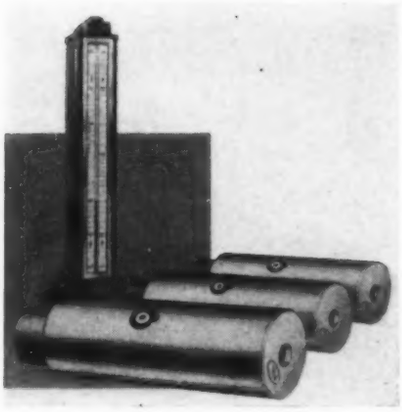


Federal Class B gaging heads from 0.240 to 2.510 in. in dia. are not plated and lapped

Federal Class B Gage Heads Equip Air Gages for Short Run

Class B gaging heads are available for use with the Federal-Metricator air gaging system, manufactured by Federal Products Corp., 1144 Eddy St., Providence, R. I. This applies to gaging heads from 0.240 to 2.510 in. in dia.

Their principal difference from the regular gaging head furnished is that they are not chrome-plated and lapped. They are hardened steel, ground and have the same degree of accuracy as the higher-priced heads made by the company.

Double-End Kennamill Blades Simplify Cutter Resharpening

Kennametal Inc., Latrobe, Pa., has developed a milling cutter, called the Universal-Face Kennamill, which consists of a heat-treated steel body with a set of detachable solid Kennametal blades held in position.

Five standard sizes are available: 4, 6, 8, 10, and 12 in. in dia. Blades for these are of the same cross-section, and when shortened by regrinding, can be used in smaller cutters successively. They are formed at both ends, and can be used in either right- or left-hand cutters. The face mill can be adapted for milling different materials by interchanging blades in the body.

Blades are wedged in the body at fixed angles, 15° dish, or concave 7° negative axial, and 15° positive radial. In this condition, the cutter is suitable for milling light alloys. The effective radial rake is changed to 10° positive for cast iron and 7° negative for steel, by grinding a narrow land on the working edge of the blade at the required angle. The true cutting angle in each case is, however the resultant of axial, radial, and nose components; 14° positive for light alloys, 8° positive for cast iron, and 8° negative for steel.

These cutting angles and the use of an exceptionally strong carbide in the blade, have, through tests, produced these results: low power required to form and remove chips; high rate of metal removal; no coolant required, as the heat of cutting is absorbed by the chips while the work and cutter remain cool; good surface finish on deep cuts and at heavy chip loads and longer cutter life.

When the blades become dull they may be removed from the body, or tool holder, while it remains on the spindle, and sharpened on a stand surface grinder by a diamond wheel, while being held in a fixture, or grinding block, which is placed on the magnetic chuck in successive positions for uniform reshaping of the cutting and clearance angles. Resetting of sharpened blades by hand is quickly performed and requires no special skill.

With the cutter body still on the spindle, one blade is placed into any slot, and securely wedged in position. Then a radial fly-cut is made in the piece to be milled, or in a block provided for the purpose. The remaining blades are each in turn placed in a slot, moved out to the shoulder of the fly-cut, at a new point on the milled arc, and securely wedged.

Because wedging components are finished to close tolerances on dimensions and angles and blades are interchangeable, they can be accurately positioned to a maximum run-out on the periphery of a few thousands. As the cutter body does not have to be removed from the machine, all handling and reassembling problems are simplified, particularly for complicated setups. The effects of errors in spindle setups are annulled, because blades are hand-set to fit existing conditions.

TRADE PUBLICATIONS

Motion Pictures—GES-40 2J describes a library of sound and silent 16- and 35-mm educational films on a wide range of scientific subjects. These films are of a semi-advertising nature, hence are very well done and their educational value is probably improved. They are loaned, without charge. General Electric Co., Visual Instruction Section, Publicity Division, Schenectady, N. Y.

Grinding Wheels—Catalog No. T-45 is a 32-page booklet containing valuable information regarding many types of toolroom wheels for surface grinding, cutting-off, and all tool grinding. Macklin Company, Jackson, Mich.

Pile Drivers—Bulletin 57 contains 15 pages of data on a new line of single-acting pile hammers particularly suitable for underwater work which can be operated on steam or air. McKiernan-Terry Corp., Park Row Bldg, New York 7, N. Y.

Spot Conveying—Bulletin FP-1 24-4-15M describes a system of portable, endless-belt conveyors. Each unit has self-contained power and is mounted on casters for instant placement where needed. With a choice of three lengths (10, 5 and 3 ft.) a conveyor can be assembled to join any two points, and all power units are timed to assure uniform speed. Island Equipment Corp., 101 Park Ave., New York 17, N. Y.

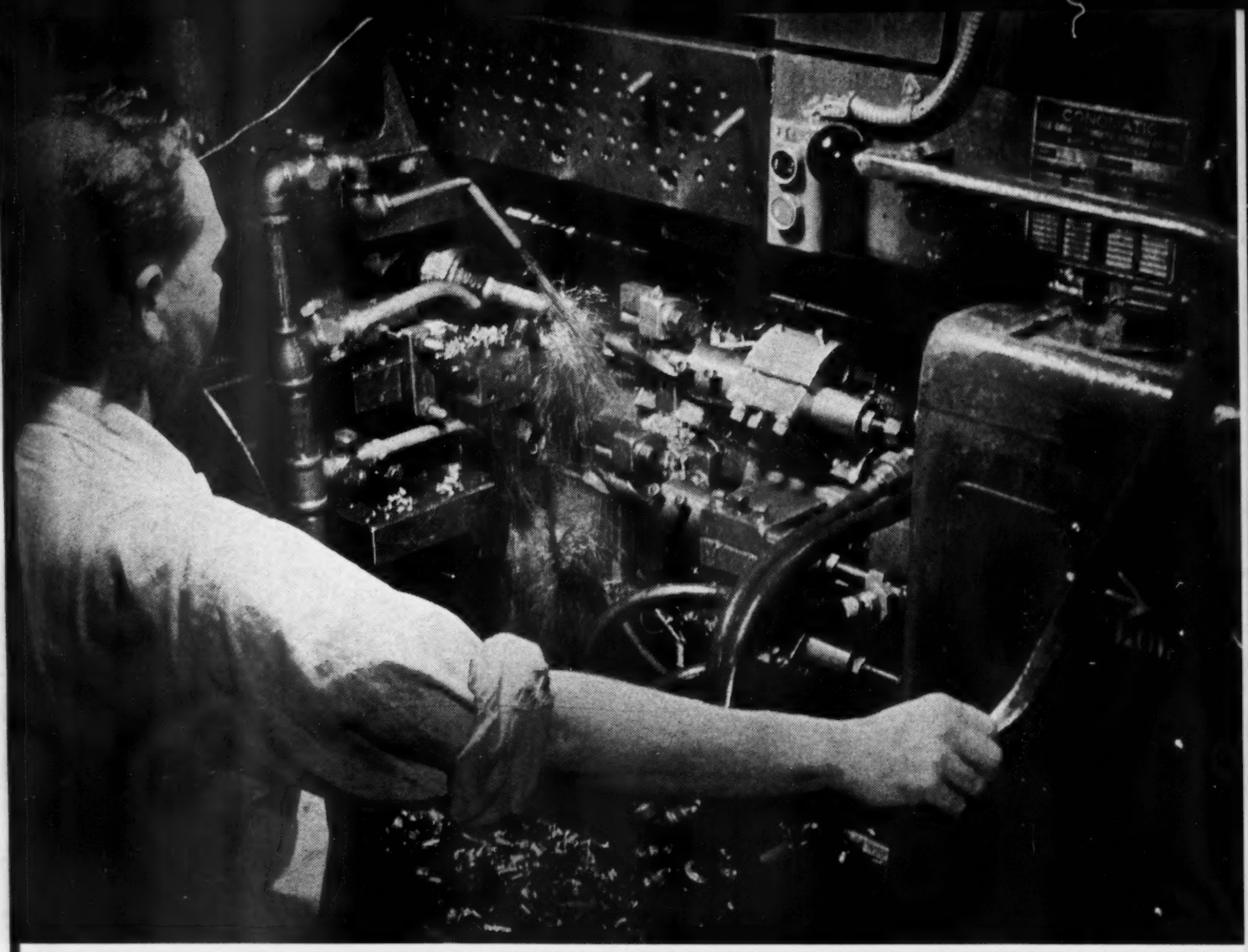
Taps—Catalog No. 3, in 10 pages, covers 63 tapping classifications, and extensive engineering data on all kinds of threads and threading including fits and tolerances and lubricant specifications and recommendations. The Hy-Pro Tool Company, New Bedford, Mass.

Thermocouples—Bulletin 32-6 is a 32-page data book on many kinds and styles of thermocouples. At the end are complete temperature-millivolt tables for adjusting and checking for all common couples. Wheelco Instruments Company, Chicago 7, Ill.

Transformer Welding Machines—"Bumblebee" booklet contains 16 pages of specifications, illustrations and description of a line of A-C welders from 200 to 500 amp. Air Reduction Co., 60 E. 42nd St., New York 17, N. Y.

Welding Rod—Bulletin W8 is a 10-page application chart specifying the proper grade of "Ampco-Trode" aluminum-bronze welding rod for electric welding all kinds of alloys. Several outstanding examples are pictured and described. Ampco Metal, Inc., Milwaukee 4, Wis.

Wire Cloth—Bulletin 79 features special applications of wire equipment such as high-temperature conveyor belts, chemical-resistant filter-screens, and baskets and trays to meet severe conditions. The Cambridge Wire Cloth Co., Cambridge, Md.



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Operation: Turning (2⅛" Form-Tool), drilling and reaming (3⅛" depth), knurling
Material: 1335 Hot rolled bar stock
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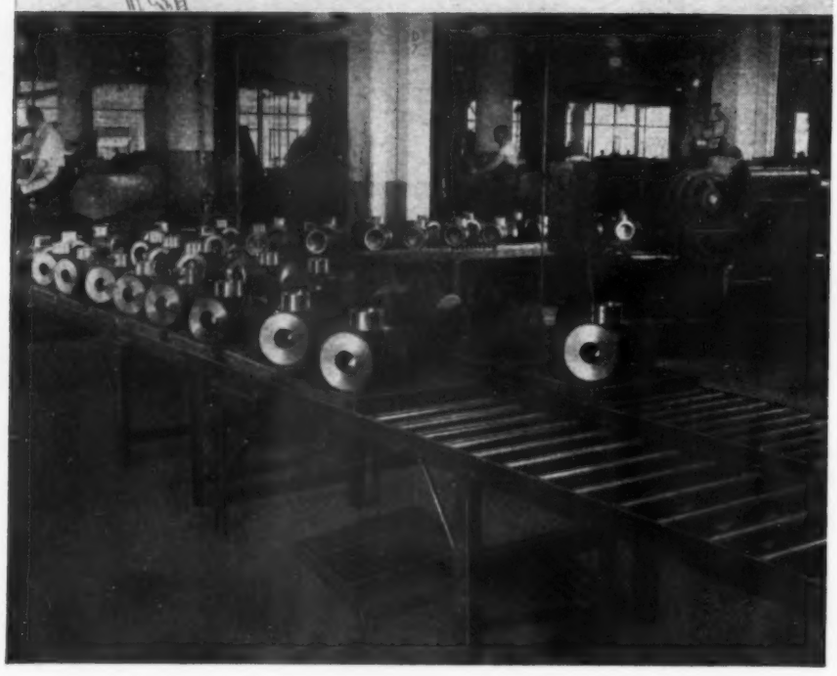

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ORDER and cleanliness — freedom from congestion—smooth flowing channels for production — safety for workers — these are important additional advantages gained from conveyors — they contribute substantial added savings to time and handling-cost economies conveyors provide.

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What is the Foreman's Job?

BY DAVID T. ARMSTRONG

THE BARRAGE of material directed at the foreman from all sides, sometimes confuses him and he wonders, "Well, just what does my job consist of anyhow? What do they expect me to do? Why doesn't somebody give me a clear statement?" These are fair questions that deserve reasonable answers.

A foreman is charged with maintaining manufacturing processes on a level sufficiently high to insure the quality and output that will enable the company to fulfill its orders and to meet competition. He must often do this with the help of untrained, uninterested and inexperienced workers who need his help to tell them what they are to do and how to do it. The foreman is further expected to see that workers do what they are supposed to do and that they make parts to meet the specifications indicated.

The foreman must possess the characteristics and qualifications of successful leadership and bring these into effective play in actual shop practice. Naturally, he must secure the confidence of the workers. He must know that golden mean between too much aloofness and too much familiarity. He must be able to rebuke a worker for inefficiency or carelessness without earning eternal or temporary resentment and bitterness. He must convince by precept and practice that he is working with his men as a leader rather than over them as a boss or "whip." He should know how to put life into a sluggish, apathetic department, so the work will be done quickly, happily, and economically. He must learn how to be kind without creating the impression of being a softie. He must make a fine distinction between being firm and yet fair. He must know how to be hardboiled without being grouchy. He must know how to get things done quickly and precisely as indicated without being punctilious and finicky.

The foreman must know his men so well that he knows when to use thick-skinned tactics on and when to deal gently. He knows that when a piece of work is spoiled the man who feels bad inside does not require the same treatment as the man who takes the attitude, "Oh, its not so bad. You've got to expect some spoilage." The personal element in human relations is vastly different from the characteristics

NEW INFORMATION ON INSPECTION COST-CUTTING

This 24-page booklet contains new information on Sheffield Visual Gages (5 magnifications). The uses of many accessories which have proved so valuable in economical, rapid and accurate dimensional control, are illustrated and described. New applications are shown. ● This booklet is of equal interest to prospective as well as to present Visual Gage users who will find new ways of putting Visual Gages to work on peacetime production.

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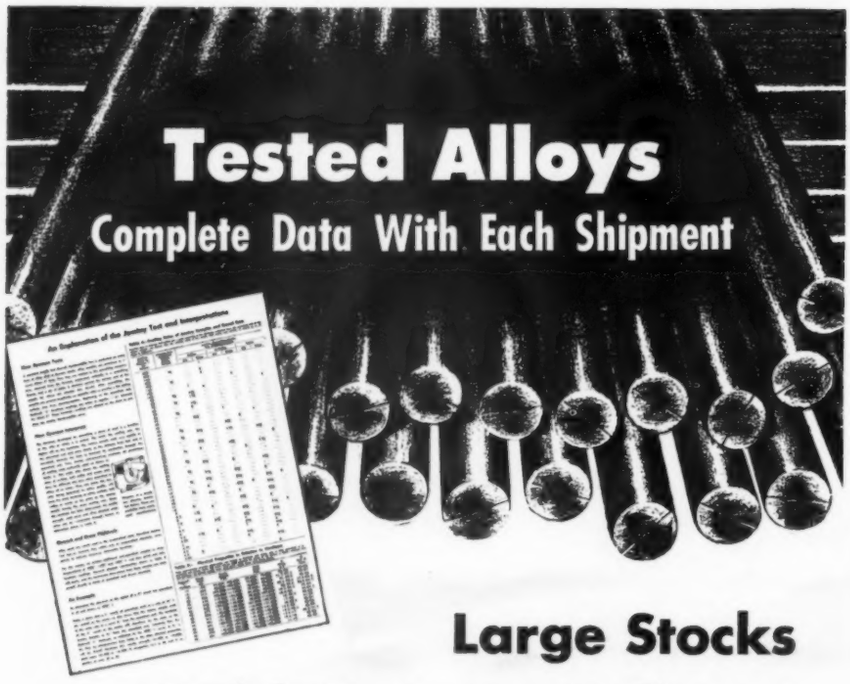
UNCONTROLLED INCIDENTAL ALLOYS PRODUCE NON-UNIFORM STEEL

Modern Warehousing Demands Testing of All Alloys To Assure Accurate Knowledge of Physical Properties

A quick return to pre-war alloy steel analyses has proven no simple task for two reasons: (1) Much of the alloy steel scrap today contains sufficient residual alloys to create noticeable irregularities in heat treatment response, if used in the production of former alloy grades requiring only one or two principal alloying elements. (2) Thousands of applications have proven the worth and advantages of steels containing three alloying elements when judged on a performance basis. The only practical way to buy alloy steels today is to know both analysis and heat treatment response. One firm offering warehouse steel has developed a plan for furnishing complete test information with each shipment. *See advertisement below.*



Large Stocks
Quick Ryerson Delivery

Take advantage of this unique service on all Ryerson alloy steels. Each heat of alloy steel is thoroughly tested for both analysis and hardenability. This information, plus an interpretation of the test results, is furnished in a report which accompanies each shipment of alloys from that particular heat of steel. There's no mistaking Ryerson alloys, because stamped heat symbols and painted color markings are cross referenced with the data reports furnished.

For every assurance of accurate heat treatment response use these pre-tested steels. Large stocks on hand offer wide selection of analyses and sizes. Call Ryerson first for quick stock shipment of quality alloys.

Write for stock list.

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Steel-Service Plants: Chicago, Milwaukee, Detroit, St. Louis, Cincinnati, Cleveland, Pittsburgh, Philadelphia, Buffalo, New York, Boston.

RYERSON STEEL

of a precision shop tool. Practical experience has shown again and again that a micrometer will give exactly and precisely the same reaction to the same inspected piece on a variety of occasions. But when a worker goes home in a jovial mood, there is no means of predicting that he will be in the same frame of mind the next day.

A foreman must be a good supervisor because good good supervision is an urgent need of every plant. Amplifying the rather common idea that the foreman should tell workers what to do and how to do their jobs, it is suggested that he go much beyond that and help his men grow in production efficiency. Instead of the old type of corrective supervision which waited until a man did something wrong before setting him right, the new order requires preventive, constructive, promotive, and creative supervision. This requires a leader who with broad vision develops his department into a coordinated, unified body, capable of carrying work projects to successful and speedy conclusions.

No leader can expect ever to do all his vision shows to be desirable, but every foreman ambitious and conscientious to develop in industrial leadership can by intelligent and persistent effort become better than he was. The principles of good supervision are not based on scientific research, because as yet industrial research on these problems is in its infancy, but rather on a body of principles that carry their own conviction by virtue of their common sense. The suggestions made here are based on this philosopy, which has been developed and enriched by some experience and much observation.

How Good Is Surplus Machinery?

BY HENRY C. FRANCIS

NOW THAT the fighting is over we will soon be faced with the problem of surplus machine equipment of many kinds. The arsenals and other government agencies have counted on improving the general quality of their equipment by securing machinery no longer needed by war plants. This has not been generally successful to date. Production managers of arsenals state that the percentage of good machine tools released by munition cut-backs is surprisingly small. This is attributed to several causes. Most operators have

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VICKERS HYDROMOTIVE EQUIPMENT

The myriad requirements of war demonstrated the amazing versatility of Vickers Hydraulic Controls. There were so many kinds of jobs to do—jobs which had to be done better than ever before—jobs which had never previously been accomplished.

For example, in this illustration, the plane has Vickers Hydraulic Control for brakes, automatic pilot and cargo door operation. The lift trucks have Vickers Hydraulic Control which lifts and positions the load accurately at the finger-touch of the operator. The graders building air fields use Vickers Hydraulic Power for steering front and rear wheels, raising, lowering or side shifting the blade, and operating the attachments.

These are just a few of the war jobs Vickers Hydraulics have done. Others include the precision movement of heavy battleship turrets—the automatic aiming of anti-aircraft guns—the fast precision positioning of ammunition hoists—the control of bomber gun turrets—and others which, cannot yet be described.

Many of the intricate machine tools that produced the machines that won the war depended for their accuracy, production speed, and ease of operation upon Vickers Hydraulic Controls.

This demonstration of the remarkable versatility of Vickers Hydraulic Controls suggests many new applications to a wide variety of postwar equipment.

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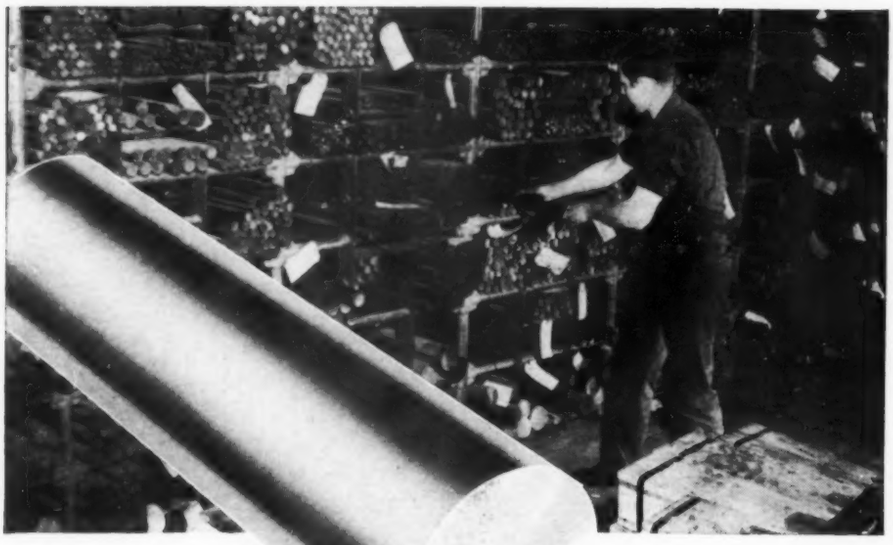

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...for higher strength...good surface finish...compact structure

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Extruded Ampco products are available from a modern extrusion mill, with the largest extrusion press in the Middle West and one of the few in the world devoted exclusively to the extrusion of aluminum bronze.

Barstock, heavy walled tubing, and various shapes are provided to meet your needs—from a mill that contains all the modern equipment required to handle this type of work.

The quality of Ampco extruded stock reflects care and consideration of detail in each step of the process—controlled melting and alloying, exact billet casting and billet heating technique, plus careful inspection of the finished product.

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been unskilled, the machines have been used on three shifts at top capacity, and in too many cases, they have not been cared for as though they had been privately owned.

If a majority of surplus machine tools are in as bad condition as has been reported, we should adopt a sound policy in disposing of it, especially to other countries. Several methods of handling the disposal of used surplus machine tools have been proposed, such as:

Having machine tools examined by their builders and rebuilt by them if their condition warrants; having all surplus machines offered for sale be examined by men appointed by the National Machine Tool Builders Association and their condition stated; allow no used machine to be sold abroad until its condition is attested by its maker, by a board of the N.M.T.B.A. or some similar body. The misrepresenting of damaged machines to foreign buyers has sadly hurt our reputation in the past and has driven customers to European builders of machines.

Still another method has been proposed, which places all the responsibility on the dealer who sells it. This would compel the dealer to deposit half of the price of the machine in escrow until the machine has been set up and operated satisfactorily in the buyers plant from 15 to 30 days.

Such a plan would, of course, carry the proviso that the machine would have to be protected from weather after its arrival at the buyers port and be put to work within a specified time. While this would eliminate the cost of inspection in this country, it might not prove a perfect answer, even though the buyer would not get any part of the money in escrow, in case of rejection. This money would revert to the U. S. Treasury and should be a strong deterent against misrepresentation.

Regardless of the methods used to handle surplus machine sales, it is still a problem worthy of careful consideration. We must remember that many flourishing concerns today could not have started in business if it had not been possible to buy more or less decrepit machines in the beginning when funds were almost non-existent. Bady worn machines can be put to use in many cases, by good mechanics in small shops. The real problem is to prevent machines in poor condition being sold under false pretenses.

If the reports by arsenal production men are borne out by others, the problem of surplus machinery may not be the menace the machine tool builders that has been feared.

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ANOTHER notable advance in the line of Nicholson Rotary Files! With a hardness close to that of the diamond, Nicholson Cemented Carbide Burs have up to *fifty times the wearing qualities of high-speed tool steel.*

Being *precision ground* (not hand ground), the flutings of these burs are absolutely uniform; radii and circumferences are faultless.

Nicholson Cemented Carbide Burs cut all types of metal. They can be operated at very high tool speeds. This, with their precision action, enables faster, more accurate and more efficient cutting—under pressure so light that chipping or breakage is rare.

Nicholson Cemented Carbide Burs are "precious" tools, but relatively low in cost when based on their extraordinary work capacity and long life. Ask your distributor for prices and other details. Or, write us direct for further information.

NINE STANDARD SHAPES, *ranging from two to six sizes and ¼" to 1" stock diameters.*

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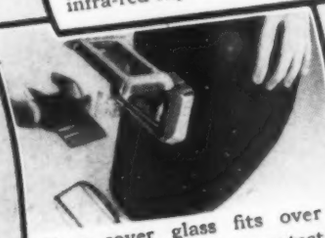
Formula for welding eye safety: Willson One-Piece Welding Helmet *plus* green Willson-Weld glass *equals* dependable protection—from heat, glare, metal spatter, ultra-violet and infra-red rays.



Clear cover glass fits over Willson-Weld lens to protect it from pitting. Both lens and cover glass are easy, economical to replace. Helmet covers both front and sides of face and neck.

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NAZI TUNGSTEN HOARD PROVED INSUFFICIENT

BY HARRY CRUMP

CARBIDE TOOL SPECIALIST, TECHNICAL INDUSTRIAL INTELLIGENCE COMMISSION FEA, AND VICE PRESIDENT, CARBOLOY COMPANY, INC.

OF THE TWO major substitutes developed by Germany, neither proved as effective as tungsten carbide for machining. One substitute, an aluminum carbide, although extremely hard, produced tools that were "not too good." This "ersatz" carbide could be used effectively only for taking light cuts on nonferrous metals such as brass and bronze.

Another substitute, somewhat better, was a vanadium-titanium carbide. Although some reports mentioned fairly good results production tests with sample tools revealed them to be highly brittle with a tendency to chip easily and to break down when taking anything except light cuts.

In the manufacture of tool tips from vanadium-titanium carbide, it was apparently necessary to use the hot-press method, used in the United States mainly where production quantities are small and pieces fairly large. The vanadium-titanium carbide also gave other troubles. Tools made from it had to be sharpened with extreme care in order that the material would not crack from the heat generated by grinding.

Reclaimed Carbide Dust

Even though conservation was carried so far as to reclaim tungsten-carbide from the dust of the grinding wheels used to sharpen carbide tools, the tungsten shortage in Germany became so great that other metals were substituted also for part of the cores of armor-piercing projectiles, leaving only the nose and a short part of the core body of tungsten carbide. While the U. S. projectile is extremely simple in design and easy to produce, the German projectile is composed of many parts, each carefully machined and assembled with fine screw threads. Workmanship was excellent, but many parts were highly finished when there was no need for finishing them at all.

Lack of Information

Another reason for the shortage of tungsten-carbide tools in Germany may have been the lack of printed instruction material regarding their use, application, and care.

Apparently training was carried out by groups of men who went from one plant to another, giving lectures. This rather slow process of education was further restricted in effectiveness by the tremendous labor turnover in Germany as a result of widespread use of "displaced" labor. Lack of such training and educational material may have contributed materially to the abnormally high breakage rate on carbide tools. Huge piles of broken carbide tools of all types were in practically every major industrial plant.

"Copies" of Tools

Peculiarly enough, the Germans had not copied the U. S. automatic cold-pressing process for producing carbide tips, even before they started to run out of tungsten. In many other ways, however, German industry copied American equipment extensively during the last years of the war. At the outset of hostilities, machines and tools used in Germany differed widely in design, speed of operation, and mechanical detail from those in vogue here. At the war's end, many Nazi plants were equipped with "Japanese" copies of American machines and tools. So "authentic" were some of these reproductions that in one instance at least I mistook a copy of a late-model American machine for an original. It had me stopped for a minute, wondering where they got hold of it. I had to go over and examine it closely before I found out that it was a copy—and a good one, too.

Other Parallels

In shop practices, other unmistakable parallels to modern American methods were discovered. For example, German industry apparently used tool speeds and other operating conditions very close to those of American shops in the later war years.

Sizes and shapes of the tungsten-carbide tools were almost identical by the war's end to those which had been used earlier in the United States. The practice of using standardized tools in American industry —to permit mass production of such tools—had also been adopted in Germany.

IN THE FORMING of tough beryllium copper parts, steel dies and punches wore rapidly . . . required frequent downtime for reconditioning. To remedy this, Carboloy Cemented Carbide replaced tool steel at two critical points especially subject to rapid abrasive action: the draw ring and extruding punch.

The result: Die and punch life stepped up 75 times . . . elimination of two costly copper plating operations formerly needed to insure adequate lubrication . . . quality of finish vastly improved.

Whether you work with beryllium copper, or any other metal, Carboloy Sheet Metal Dies will increase production, improve quality, decrease costs, keep presses in more continuous operation, and reduce —often eliminate—subsequent buffing or polishing.

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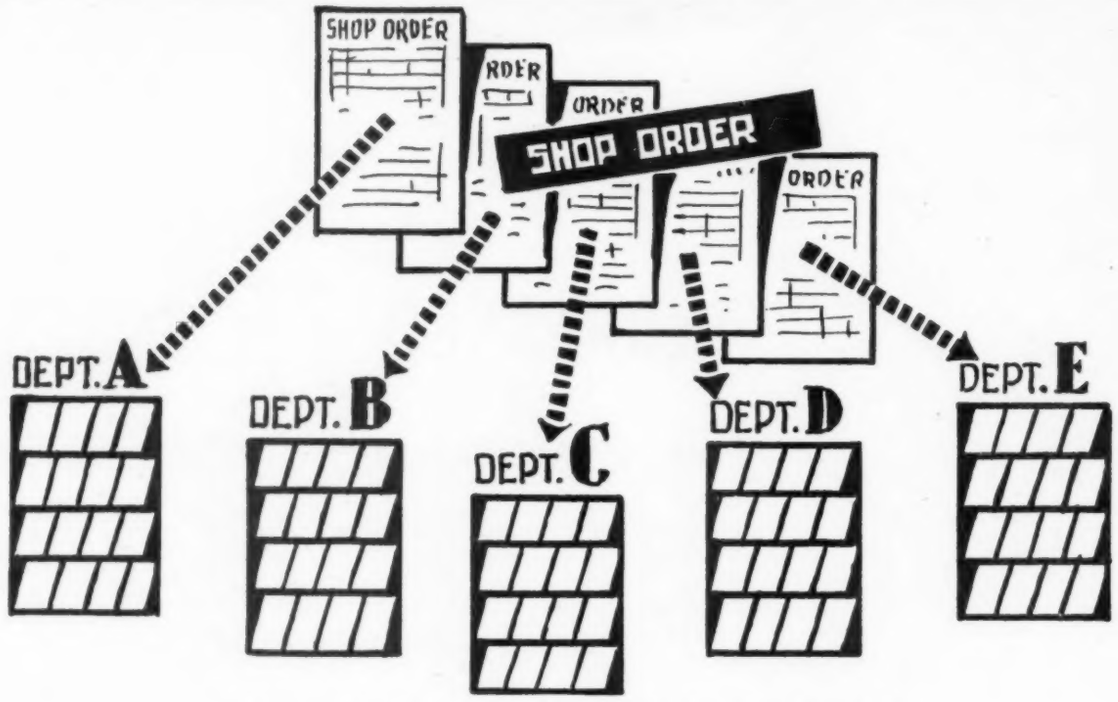

This Chart is one of a series of eight suggesting how various elements of control are secured through McCaskey by the visualizing and flow of multiple copies of a few forms that are already in use in most plants. These charts will suggest how McCaskey Control will meet your specific needs.

MACHINE LOADING, SCHEDULING and DISPATCHING through McCASKEY CONTROL

This Chart illustrates machine loading, scheduling and dispatching simply by visualizing multiple copies of a shop order in McCaskey Machine Control Sections.

Through the procedure recommended, paperwork is cut to a minimum . . . departmental planning is handled rapidly and accurately . . . schedules are quickly and easily changed. The load ahead of each machine is available almost instantly and operations are performed according to planned schedules. Job assignment is practically automatic; no delays occur while employees and machines wait for jobs.

SEND AT ONCE FOR

your copy of "The ABCc of Production Control" from which the above chart is reproduced and in which are covered a wide range of applications of control presented simply and clearly to show how McCaskey Control operates. One of the systems shown or an adaptation of it will fit your specific needs. WRITE FOR YOUR COPY TODAY.

A McCaskey industrial representative, qualified by training and experience, is available to help you analyze your requirements and suggest the McCaskey Control that will best meet them. No obligation, of course.

THE McCASKEY REGISTER COMPANY, ALLIANCE, OHIO

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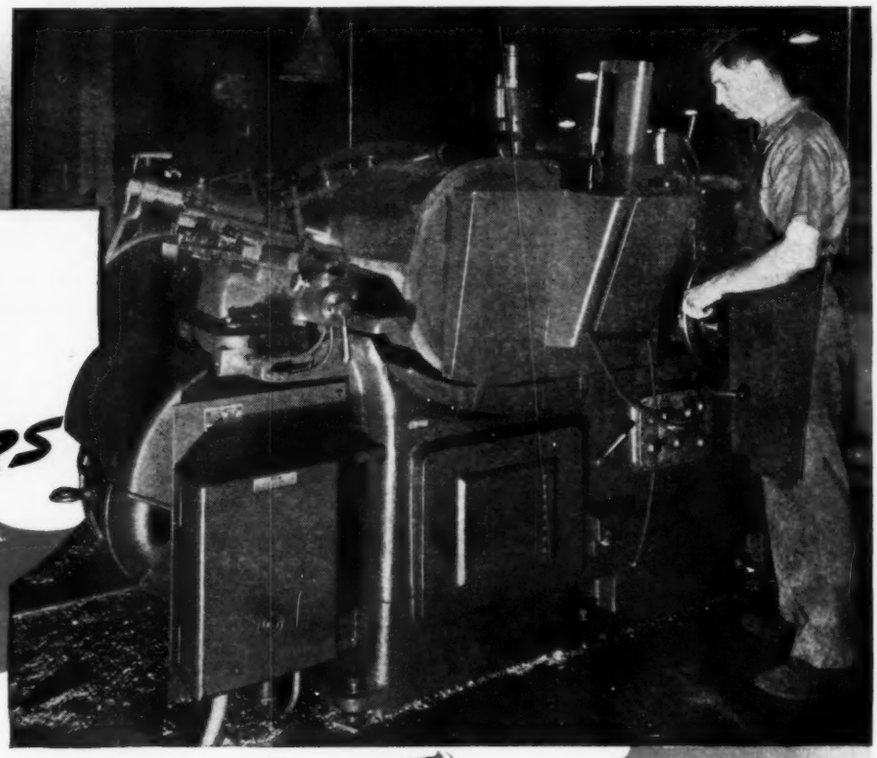

Centerless grinder driven by a Century 30 horsepower 3 phase motor.

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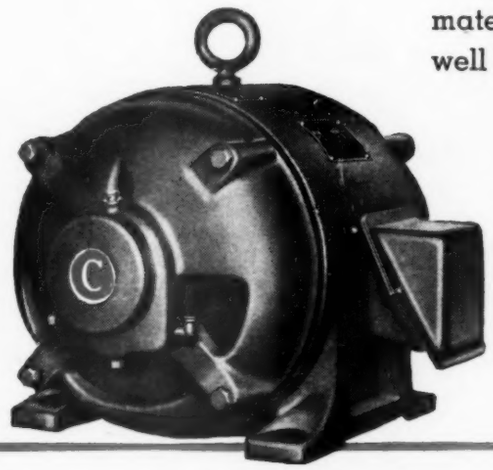
Century Motors for machine tools are built to match the precision of the machines they drive.

They are accurately constructed with plenty of material where necessary to maintain rigidity — well balanced mechanically and electrically.



Century's wide range of types and sizes of motors from 1/20 to 600 horsepower enables you to match a Century Motor to your machine.

Century Motors may be a vital factor in producing a better product at a lower cost — Specify Century.

CENTURY ELECTRIC CO. • 1806 Pine Street • St. Louis 3, Missouri

Offices and Stock Points in Principal Cities

CE-452

New

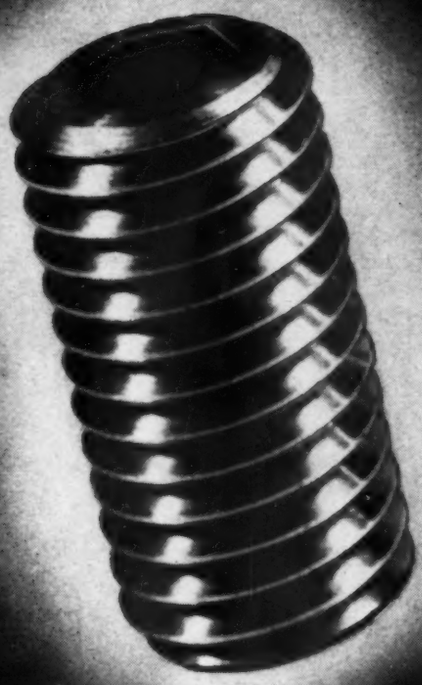
PARKER-KALON

★ Ground Thread

SOCKET SET SCREWS

Parker-Kalon – cooperating with Landis Tool Co. – has adapted centerless thread grinding – the process once employed only for producing screws used in the finest precision equipment – to quantity production of P-K Set Screws.

Made from hardened stock, with the characteristic smoothness and distinctive bright appearance of a ground finish, these new screws are as different from ordinary set screws as night and day!



P-K puts something really New in

New

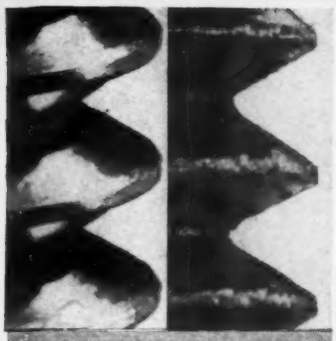
PARKER-KALON

★ Size-Marked Gear Grip ★

SOCKET HEAD CAP SCREWS

Another Parker-Kalon "first", the Size-Mark is an exclusive feature sure to be welcomed and appreciated by every socket screw user. The correct size of each screw can be seen at a glance. Together with the Gear Grip, which prevents slipping and fumbling, the Size-Mark gives P-K Socket Head Cap Screws a double feature that will save you hours of time and trouble.

★U. S. Patent No. 126,409

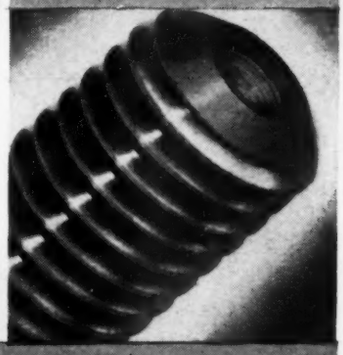


SMOOTH, CLEAN THREADS Compare the gleaming ground threads (left) with tool-marred surfaces of cut threads (right).

FAULTLESS THREAD CONTOUR AND LEAD Ground thread smoothness and accuracy are apparent in the comparator.

DEPENDABLE CLASS 3 FIT The new centerless thread grinding method assures remarkable uniformity

CLEAN STARTING THREAD Permits P-K Ground Thread Set Screws to start easier, and speed assemblies.



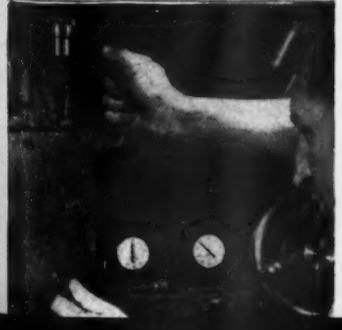
in SOCKET SCREWS

ONE QUICK GLANCE tells the size. No need to "mike" or gauge it! No chance for costly errors!

EVEN EXPERIENCED MEN need the Size-Mark. Tests show many guess wrong 50% of the time.

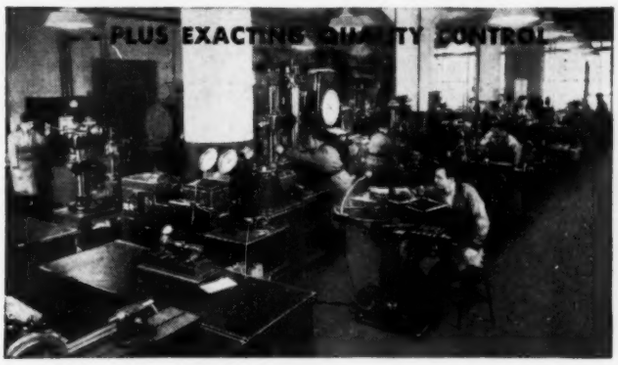
NO TIME WASTED and no wasted screws when screw sizes get mixed up, if they are Size-marked!

GEAR GRIP enables fingers to get a firm grip even when slippery with oil – makes driving surer, safer.



By adapting centerless *thread grinding* for P-K Socket Set Screws, and by adding the *Size-Mark* and *Gear Grip* to P-K Socket Head Cap Screws, Parker-Kalon gives industry the first really NEW developments in socket screws in years.

Each of these improvements offers welcome and worthwhile advantages to socket screw users . . . faster and better assemblies, improved security, elimination of errors, and time-saving in the tool-room and on the assembly line.



Parker-Kalon Socket Screws have always been held to the highest standards of accuracy, strength, and appearance by a Quality-Control routine unsurpassed in the industry. Now, Thread Grinding, the Size-Mark, and Gear Grip put them years ahead in every test of utility and performance.

GIVE YOUR NEW PRODUCTS, and your present products, the advantages of these new features. SAMPLES will be sent at your request. See them – compare them . . . and you'll agree P-K Socket Screws are the logical choice for your assemblies.

LIMITED RANGE OF SIZES NOW AVAILABLE

Present facilities permit the manufacture of only a few sizes on a quantity production basis. As soon as additional equipment is put into operation, other sizes will become available. Meanwhile, write for samples. Parker-Kalon Corp., 194-196 Varick St., New York 14.

☆ Ground Thread ☆ Size-Marked ☆ Gear Grip

AVAILABLE ONLY IN

PARKER-KALON *Cold-forged* SOCKET SCREWS

SEE THEM AT THE PARKER-KALON BOOTH

NATIONAL METAL EXPOSITION

CLEVELAND . . . FEBRUARY 4-8

COLD FORGED PARTS

INNUMERABLE parts ordinarily produced by machining operations have been made faster, at less cost, and to equally close tolerances by the application of cold forging methods. This has proved especially true at Allied where production men not only have the best of cold forging equipment at their disposal but also have the experience and ingenuity to determine how such equipment can be adapted to unusual and complicated parts.

If you require parts . . . in quantities of thousands or millions . . . which should be or might conceivably be produced by cold forging, Allied Products should be your most logical source. We'll be glad to send you further information . . . or better yet, submit your part prints to us for quotation.

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ALLIED CORPORATION PRODUCTS — PRECISION • EXPERIENCE • DEPENDABILITY

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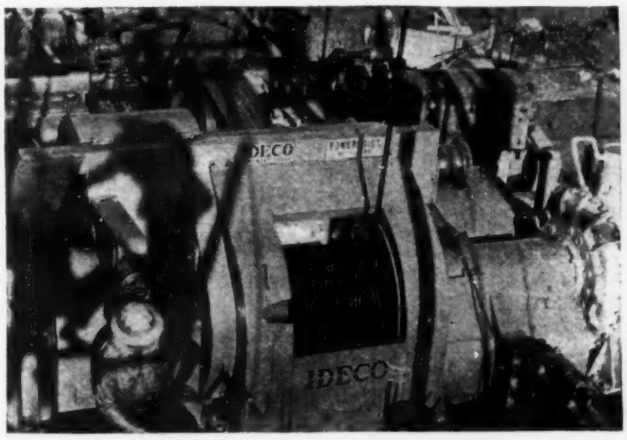
THE CLUTCH THAT STOPPED CLUTCH TROUBLE

Here is the one truly modern clutch for all heavy duty industrial drives.

It controls power and torque through a cushion of air —with as firm a grip or as light a grip as the job requires. It has no springs, arms, levers or toggles—requires *no* lubrication and little maintenance.

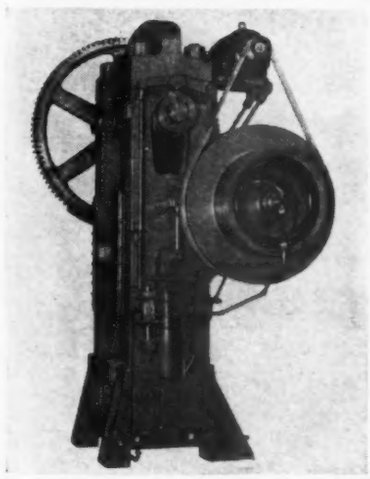
It is the Fawick Airflex Clutch—proved for superior performance and economy—in hundreds of industrial applications and in thousands of Diesel-driven Navy ships.

Let us help you engineer clutch trouble *out* of your machines. Book on request.



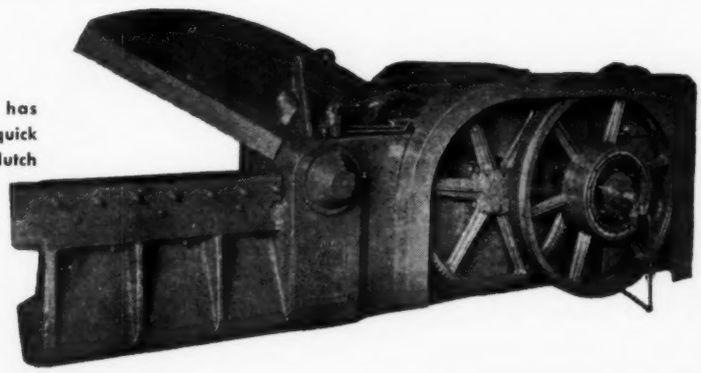
Oil-well drilling rig—equipped with 11 Fawick Clutches.

Steel rolling mill Fawick-equipped for smooth, even power.



▲ Modern power shovel gives full-time operation through dependable Fawick Clutches.

◀ Heavy duty press has smooth starts and quick stops with Fawick Clutch and Brake.



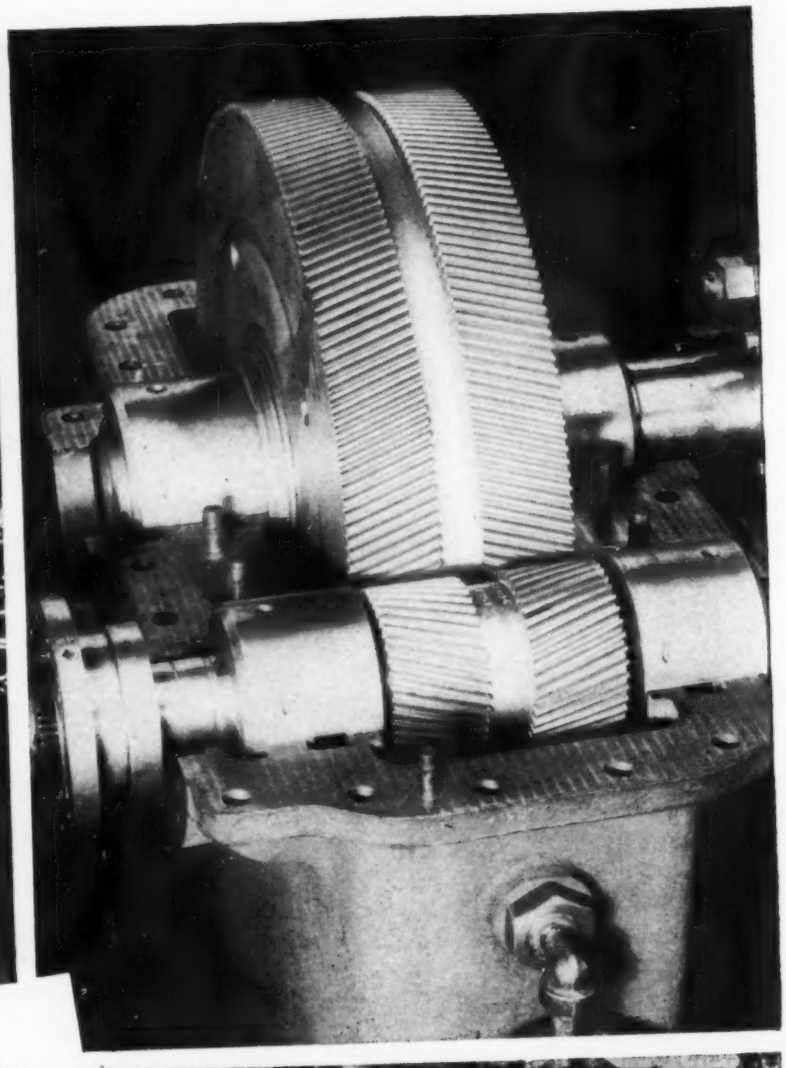
▶ Alligator shear operates through Fawick Clutch and Brake.

FAWICK *Airflex* CLUTCH

FAWICK AIRFLEX CO., INC. • 9919 Clinton Road, Cleveland 11, Ohio

In Canada, Roynald-Coventry Ltd., Montreal, Toronto, Vancouver • In Britain, Crofts Engineers, Ltd., Bradford, England

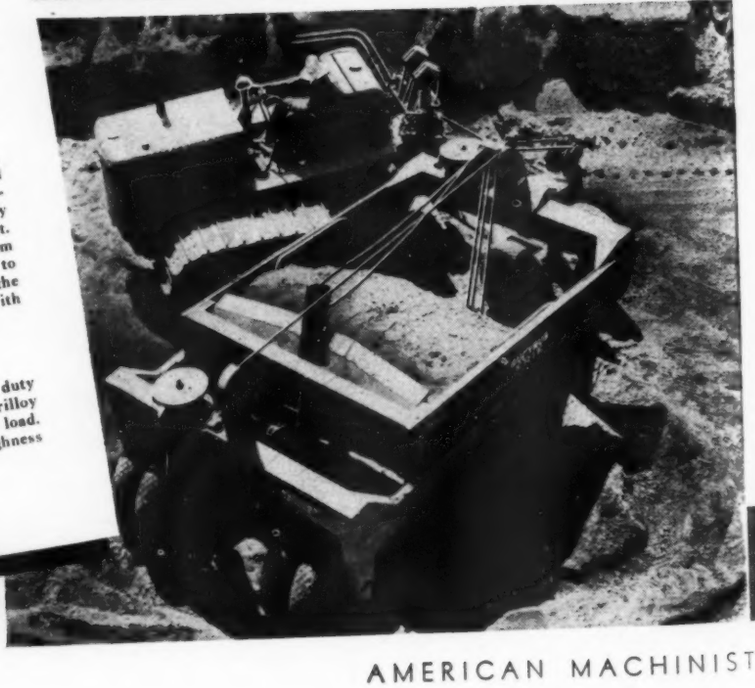
FOR ANY PART OF YOUR PRODUCT



FRAMES, STRUTS and actuating arms of this retractable landing gear are made almost entirely of special Aircraft Quality alloy steel forgings, that soak up tons of shock without weakening or giving way. On larger planes hydraulic cylinders are shaped and welded from alloy steel plate.

U·S·S CARILLOY GEAR STEELS are consistently uniform, not only in case of forging, in response to annealing and heat treatment, and in case of machining, but this uniformity has been extended to include a much less easily controlled effect—uniform distortion in heat treatment. Thus in heat treating gears of U·S·S Carilloy, the minimum amount of distortion that does occur can be counted on to remain constant. With procedures once established, the gears can be kept uniform, to close limits of accuracy, with least fabricating difficulties and minimum rejections.

STAMINA AND DEPENDABILITY, essential in heavy duty equipment like this, are assured when U·S·S Carilloy Steels in axles and shafting, bear the brunt of the load. Their use provides the wide margin of strength, toughness and safety necessary for these vital parts.



THAT HAS TO TAKE A BEATING...

—Put it up to Alloy Steel!

WHEREVER your product needs greater strength and toughness, wherever you want to reduce its weight or increase its resistance to wear, fatigue and shock, wherever it must withstand high temperatures and pressures, the *right* alloy steel properly applied will most often answer your problems. And generally at a cost that fully justifies its use.

In U·S·S Carilloy Steels we place at your disposal the most complete line of high quality alloy steels developed to date. Bearing Steels. Aircraft Quality Steels. Creep Resisting Steels. Nitralloy Steels. Triple Alloy and Special Analysis Steels, as well as other AISI Steels. In all grades, in all finishes and treatments, and in the widest range of forms and sizes available anywhere. They are produced either by Electric Furnace or Open Hearth process.

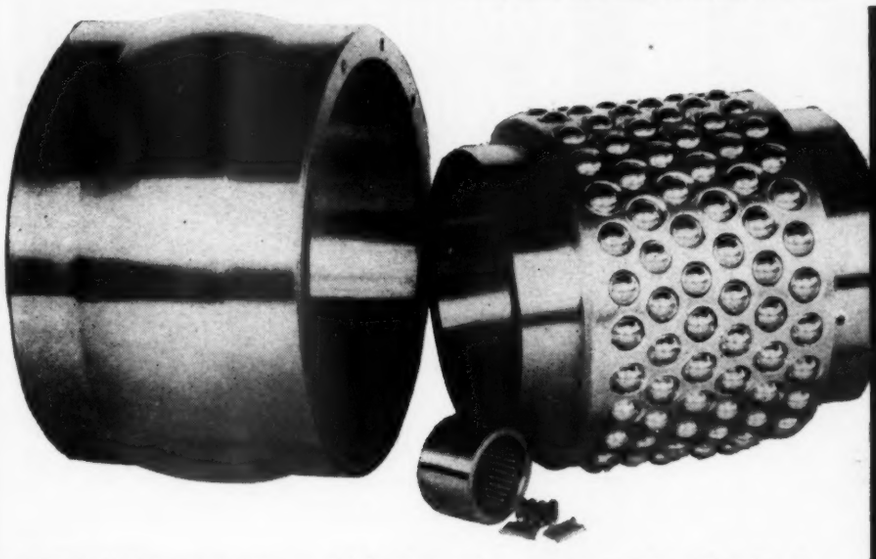
Literally millions of tons of these special purpose steels have been successfully used in critical wartime applications. Here, in the severest test that steel has ever had to face, U·S·S Carilloy Steels have done an outstanding job that has earned them a place right at the top of your list when tough postwar assignments are under consideration.

Produced both in our Chicago and Pittsburgh plants, these superior alloy steels — and the specialized metallurgical and engineering knowledge accumulated in their application—are available to give your products those qualities of greater efficiency, greater permanence and greater sales appeal, that will help to place it not merely abreast, but ahead of competition. We welcome the opportunity to work with you.

CARNEGIE-ILLINOIS STEEL CORPORATION

Pittsburgh and Chicago

Columbia Steel Company, San Francisco, *Pacific Coast Distributors*
United States Steel Export Company, New York



WHERE PRECISION IS A "MUST", as with bearings and gears, the unvarying uniformity of U·S·S Carilloy Steels helps designers meet difficult performance standards. These steels are easy to forge, easy to machine, and respond consistently to annealing and heat treatment.

U·S·S Carilloy Steels

ALLOY STEELS FOR THE SPECIAL JOBS OF INDUSTRY

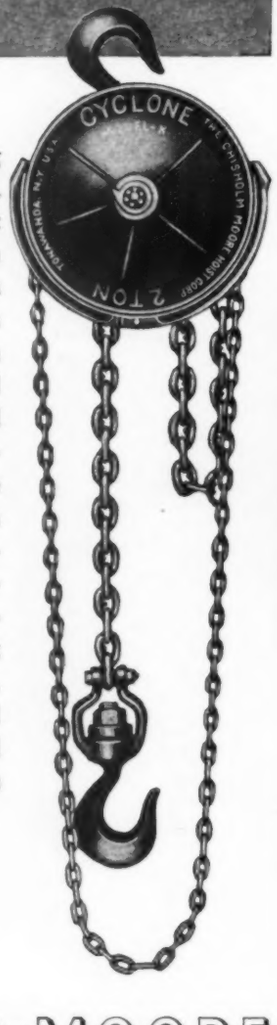
USS STEEL — UNITED STATES STEEL

UNITED STATES STEEL

CM

Here's a hand operated hoist with 12 BEARINGS!

CYCLONE



Faster action, higher operating efficiency, lasting endurance, easier handling—that's what you get in the aptly named High Speed CYCLONE Hoist. You can depend on this "tops in performance," because only in the CM Cyclone will you find **12** anti-friction bearings—a ball or roller bearing at *every* rotating point. Other extra value features are: Extra safety from the smooth gyrating yoke action... internal guides to prevent load chain slippage... accurate meshing of machine cut gears... shielded lift wheel... CM "Inswell" electric weld load chain. For a hand operated chain hoist here, definitely, is outstanding value.

Capacities from ¼ ton up. CM Bulletin No. 100 contains complete details. Write for it.

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The "GUSHER"—A Modern Pump For Modern Machine Tools

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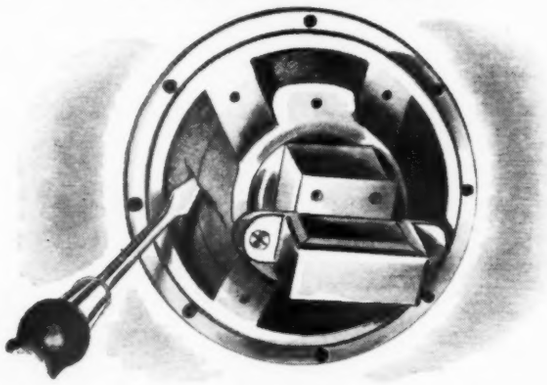
How Phillips Screws Saved Emerson Radio $40 Daily Spoilage

THIS INVESTIGATOR from James O. Peck Co., industrial research authorities, is visiting a number of representative plants to get authentic FACTS on assembly savings for you.

GET HIS UNBIASED REPORTS READ THE COMPLETE FACTS!

100 Driver Skids a day eliminated ... at 40¢ a skid!

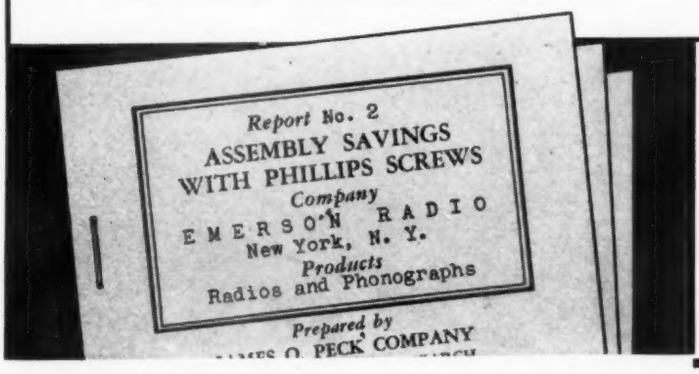


EMERSON RADIO & PHONOGRAPH CORP. use Phillips Screws for one good reason... *they cut costs!* Good example is the daily saving of $40 formerly used up reclaiming loud speaker cones ruined by driver skids from slotted screws.

That's only one way Phillips Screws save. They can be driven faster – allow use of power in place of hand drivers. They drive tighter – fewer and smaller screws can often be used. Burrs and broken screw heads are eliminated, and the ornamental design improves product appearance.

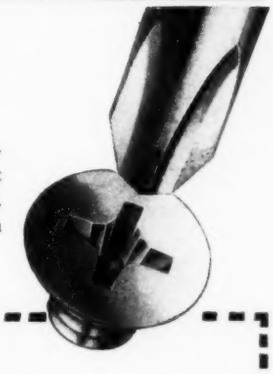
NOW, THESE UNBIASED REPORTS show how these advantages result in savings that add up *big* in yearly assembly records – savings you can't afford to miss with today's squeeze on profits.

THE ASSEMBLY STUDIES COVER ALL TYPES OF PRODUCTS – metal, plastics, wood. The report on Emerson – others now ready – and more to come – make up a practical manual of modern assembly methods, never-before-printed information, inside facts you'd pay good money to get, – and it's yours, now, FREE!



WHATEVER YOU MAKE, THERE ARE SAVINGS IDEAS HERE FOR YOU!

Find out how industry's best assembly experts cut costs! Get these reports, as they are issued. Don't wait... mail the coupon TODAY!



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Wood Screws • Machine Screws • Self-tapping Screws • Stove Bolts

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Please send me the reports on Assembly Savings with Phillips Screws

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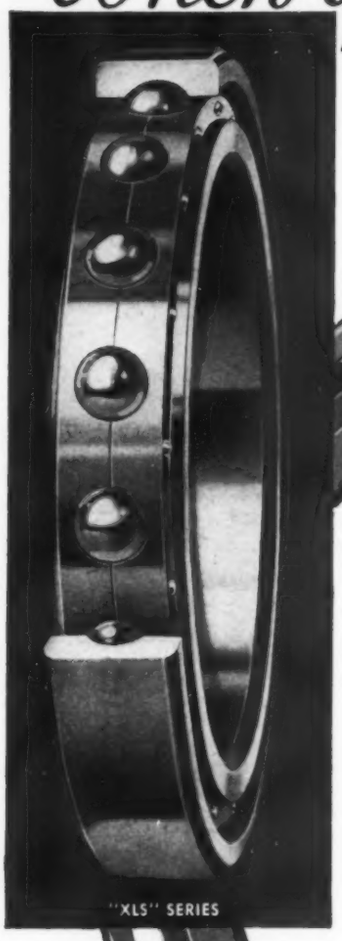
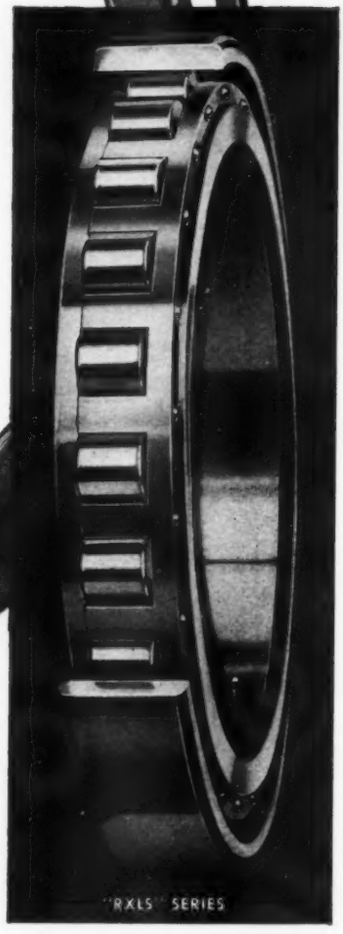
USE THESE VERY LIGHT INCH SERIES BEARINGS



HAVING bores abnormally large, as compared with the outside diameter, they offer definite advantages under certain conditions found in machine design. You may have them in several different types, *affording compactness, light weight, and greater latitude in your design.*

There are several lines of very light type ball bearings, which include the "S" starting at 1/8" bore, and the "XLS" starting at 1 3/8" bore, running up to a maximum of 21" bore and 28" outside diameter. And in very light type roller bearings, there is the "RXLS" Series, paralleling the "XLS" in size range.

Why not let our engineers tell you more about these Very Light Precision Bearings? Write for the Catalog.



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And, may we offer the suggestion that it might pay you to consider buying *all* of your gear driven power transmission devices from *one source*—and thus place the responsibility for their *performance* with *one* firm.

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BUILDING COMPLETE MACHINE TOOLS
UNITS FOR MACHINE TOOLS
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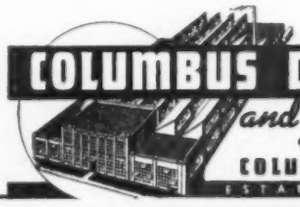

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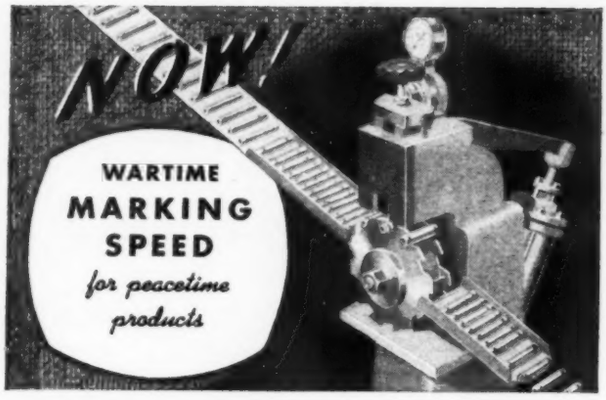
ESTABLISHED 1906



Out of the urgent demand for precision marking at highest possible production speeds have come new Noblewest marking machines for marking your peacetime products faster — better — cheaper. Model 156, illustrated, marks tubular parts. Adaptable to magazine loading. Has automatic positioning, and unloading. Noblewest Pneumatic Pressure Compensator assures uniform impression. For the answer to your marking problem write Noble & Westbrook Manufacturing Co., East Hartford 8, Conn.

MARK IT BEST WITH

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Hi-Speed Marking Machines

EACH GEAR A MASTER GEAR

and the way MEISEL builds gears, there's just one *right* gear for any specific job. Designed for use under conditions that exist, MEISEL Gears actually "belong" to a machine . . . are inherently able to give longer, quieter, more economical service. Investigate the advantages of *specifically* engineered gears by MEISEL.

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ECONOMICAL SERVICE
ALL TYPES, MATERIALS
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They save 50% on sawing, filing and lapping operations, easily maintaining .002" limits. Ask for special bulletin—also circulars on Drill Grinders, Point Thinners, Tool and Cutter Grinders, Face Mill Grinders and Tool Bit Grinders.

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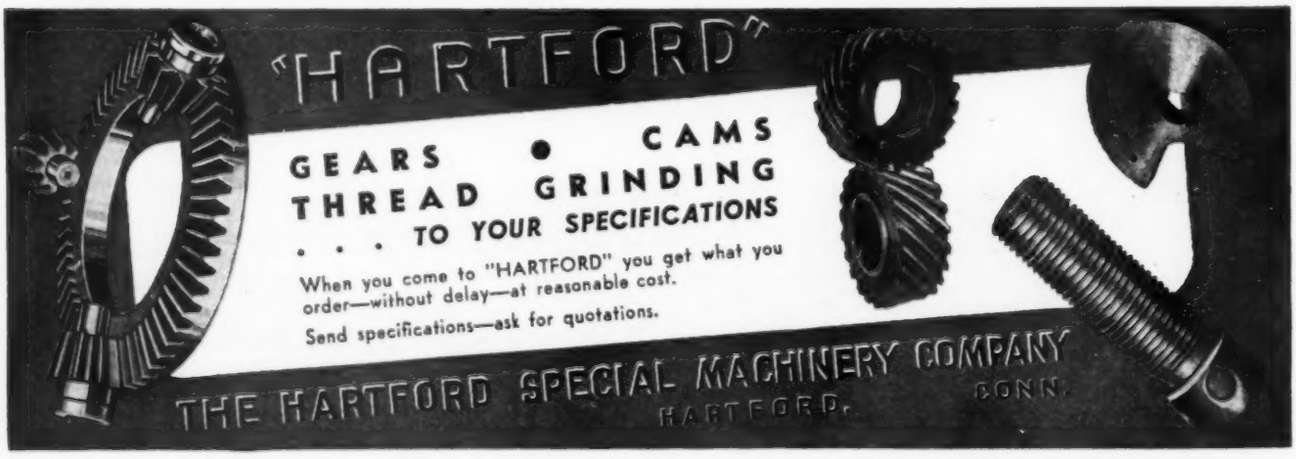
Oliver Instrument Co., 1414 Maumee St., Adrian, Mich.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GEARS • CAMS
THREAD GRINDING
. . . TO YOUR SPECIFICATIONS
When you come to "HARTFORD" you get what you order—without delay—at reasonable cost.
Send specifications—ask for quotations.
THE HARTFORD SPECIAL MACHINERY COMPANY
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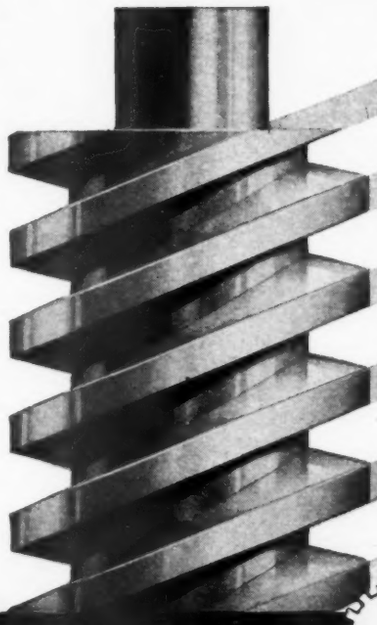

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Spiral and helical gears; special couplings, bushings and collars; pins, pulleys and rollers. Made to your specifications—*promptly.*

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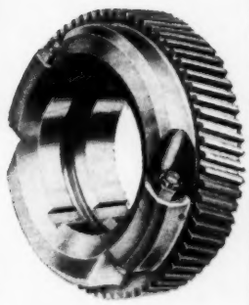

How hard a machine can work, and how long, rests largely with its gears. Demands are great, and the job must go on . . . day in and day out.

It's here that Cincinnati *Gears, Good Gears Only,* prove their value. Both in peace and war they have maintained outstanding records of performance.

Over forty years of quality with precision in serving industrial requirements have proven the wide acceptance of Cincinnati *Gears, Good Gears Only,* for the tough jobs!

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"Gears. Good Gears Only"
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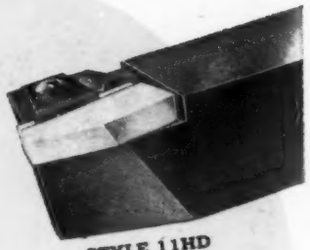
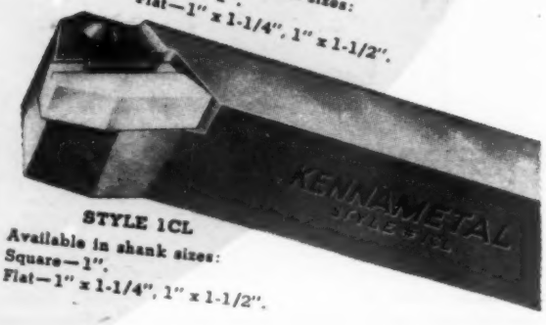
NOW - New* Clamped-on Tip KENNAMETAL TOOLS FOR LIGHTER MACHINING JOBS



STYLE 11HD
Available in shank sizes:
Square—1-1/4", 1-1/2", 2".
Flat—1" x 2", 1-1/2" x 2".

STYLE 11CL
Available in shank sizes:
Square—1".
Flat—1" x 1-1/4", 1" x 1-1/2".



STYLE 1CL
Available in shank sizes:
Square—1".
Flat—1" x 1-1/4", 1" x 1-1/2".

STYLE 12HD
Available in shank sizes:
Square—1-1/4", 1-1/2", 2".
Flat—1" x 2", 1-1/2" x 2".

STYLE 12CL
Available in shank sizes:
Square—1".
Flat—1" x 1-1/4", 1" x 1-1/2".

STYLE 2CL
Available in shank sizes:
Square—1".
Flat—1" x 1-1/4", 1" x 1-1/2".

TWO new styles of tools—straight and offset shanks—with clamped-on Kennametal tips, have been developed so that the outstanding operating and maintenance advantages that characterize our now well-known HD line for heavy duty work, may also be realized on lighter machining jobs. Among the advantages provided by these new tools are:

More consistent performance and greater durability from thermally strain-free assembly;

Smooth, unimpeded chip flow assured by perfected clamping arrangement, correctly positioned;

Exceptionally strong Kennametal tip—diamond ground on bottom face—firmly supported by plane surface of heat-treated steel shank;

Dull tips can be advanced, resharpened time and again, and major part utilized—tip only is reground;

Fewer tools to stock—many tips can be used during life of one shank;

Tips of different grades can be clamped in same shank;

Tips can be supplied with permanent, molded-in chip breaker, constant in depth, but adjustable in width by varying amount ground from end, or side cutting edges.

Illustrations show the new styles, as well as the widely used HD style, of clamped-on-tip Kennametal tools. Captions indicate sizes available.

SEND TODAY FOR SUPPLEMENT 2 . . .

. . . of Catalog 45, for complete specifications and prices.

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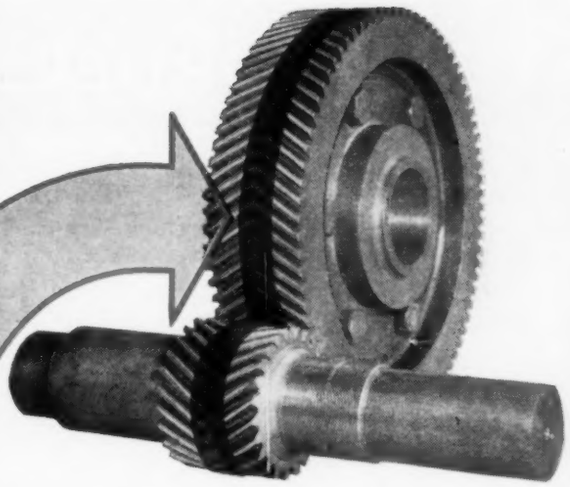
HOW THIS BACKBONE



PROTECTS ACCURACY HERE

The Farrel-Sykes continuous tooth herringbone gears which drive the headstock of this Mackintosh-Hemphill 84" heavy duty crankshaft lathe, insure accuracy at the tool point by delivering a constant, smooth flow of power to rotate the work smoothly and uniformly, even when an extra heavy cut is taken.

They are known as the *Gear with a Backbone* because the teeth are continuous across the face, without a center groove. The *backbone,* formed by the juncture of the two helices, puts the entire face width to work, providing extra strength and high load-carrying capacity in minimum space.

Precision generation by the Farrel-Sykes process... accuracy of tooth contour and tooth spacing within close tolerances... uniform distribution of the load on each tooth and across the entire face... the balancing of axial thrusts by the opposed helices... are additional factors which assure correct tooth action and contribute to efficient operation and maintenance economy throughout a long gear life.

Farrel-Sykes continuous tooth herringbone gears are made in any size up to 20 feet in diameter for practically any industrial application. For further details send for descriptive bulletins.

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344 Vulcan Street, Buffalo, New York

Plants: Ansonia, Derby and Stonington, Conn., Buffalo, N. Y.
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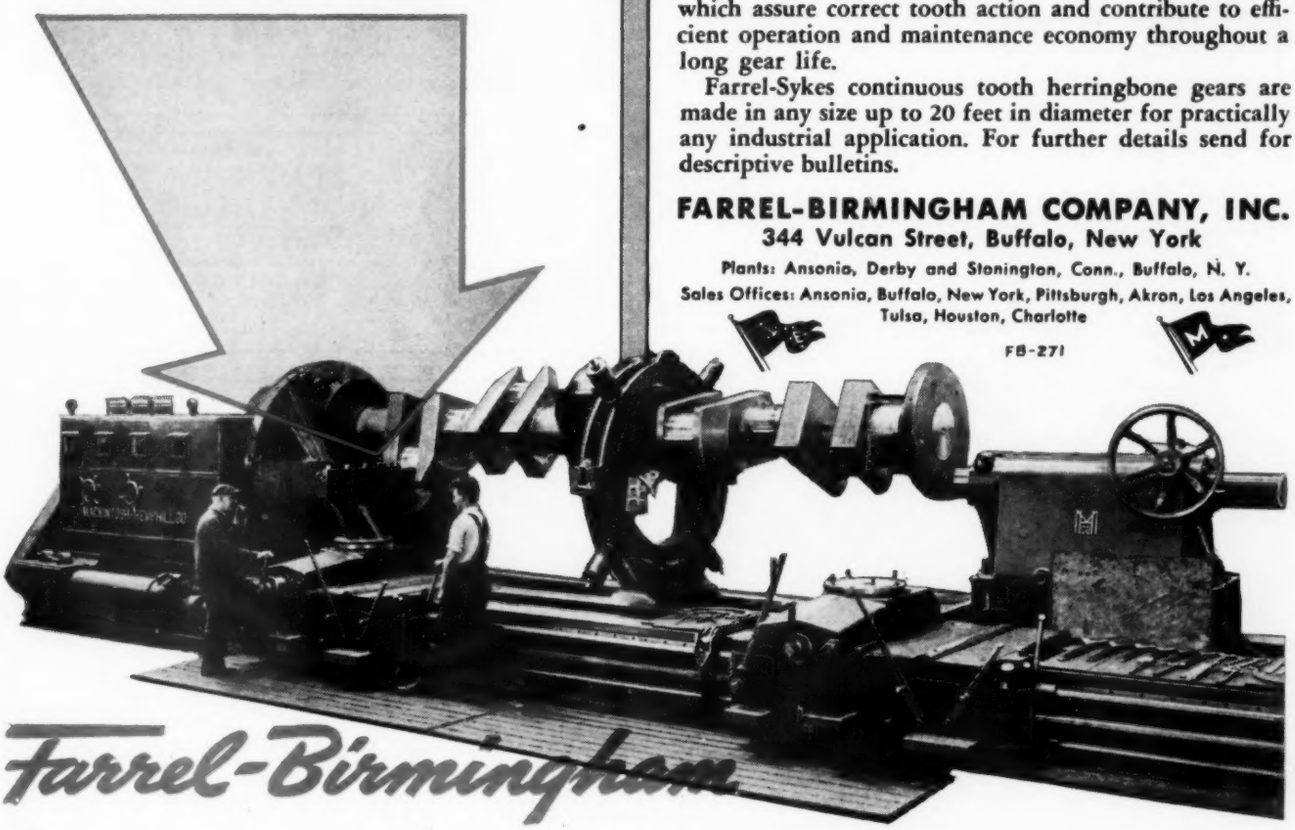
FB-271



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Many of the nation's leading manufacturers have ordered HOLE CHECKERS two, three and four times.

That's why we know it gives them what they want—quick, accurate checks of internal diameters—exposing at once any errors of size, taper, bell-mouth or out-of-round condition.

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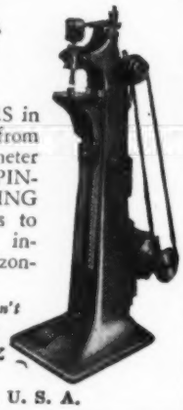

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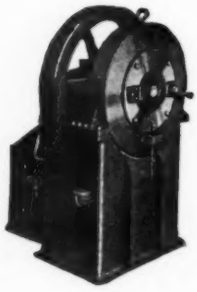

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— with 4000 forceful squeezing hammer blows per minute—makes metal tougher and more elastic. Send for booklet—"The Torrington Swaging Machine."

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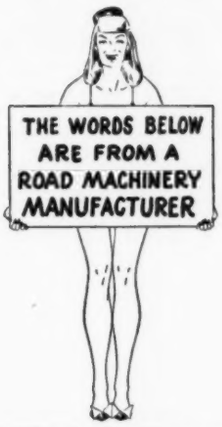

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"We installed this press brake approximately a year-and-a-half ago, and the performance of it has exceeded our expectations. This press brake is constantly in use and has saved us considerable money in the fabricating of items used in the products we manufacture. Our only regret is that we did not purchase this machine several years ago. We will be very glad to recommend this brake to anyone requiring a machine of this type."

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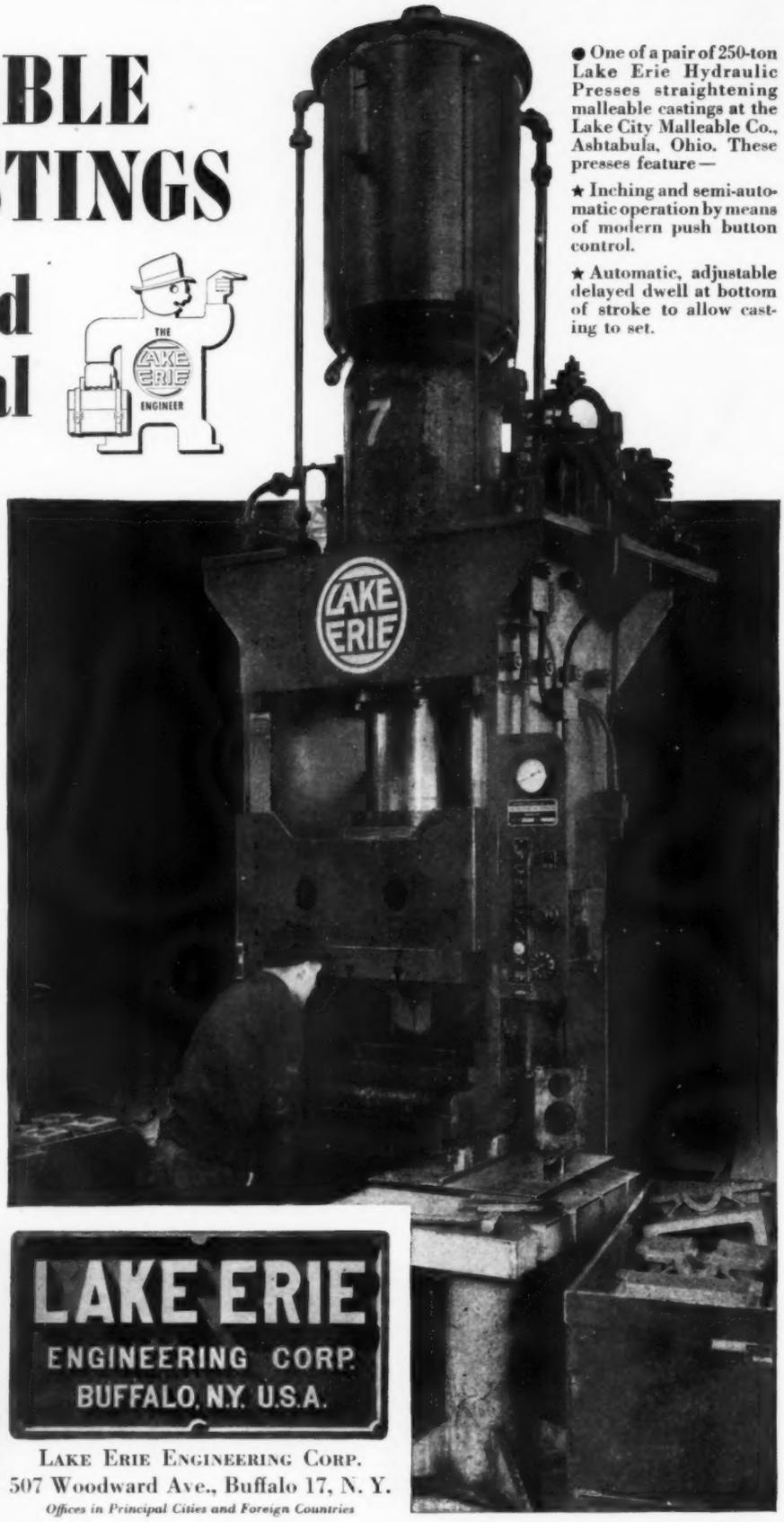
- Built-in dependability keeps Lake Erie Hydraulic Presses going... keeps production rolling.

Lake Erie Engineering Corporation is equipped through long years of experience to meet your hydraulic press requirements exactly...quickly ...usually with a standard model... but with a special model if necessary. Let us know your requirements... consult us today.



● One of a pair of 250-ton Lake Erie Hydraulic Presses straightening malleable castings at the Lake City Malleable Co., Ashtabula, Ohio. These presses feature—

★ Inching and semi-automatic operation by means of modern push button control.

★ Automatic, adjustable delayed dwell at bottom of stroke to allow casting to set.

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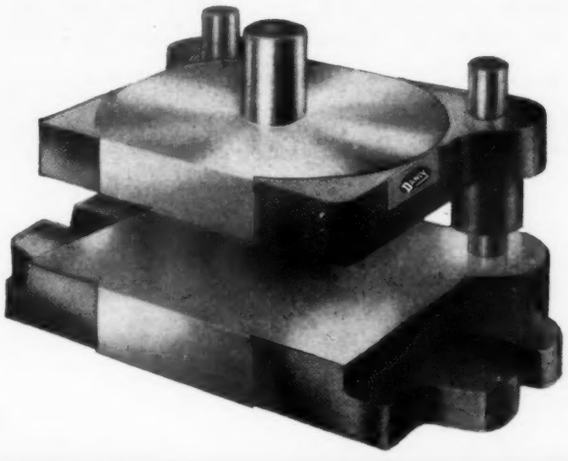

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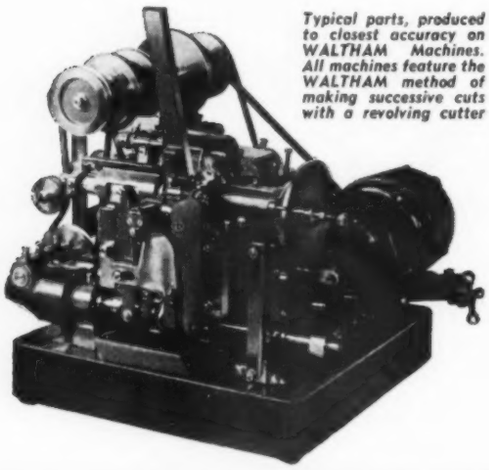
DANLY DIE SETS

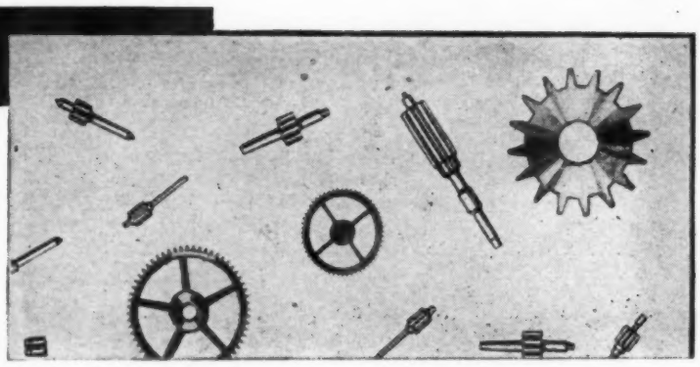
Welded Steel Fabrication

WALTHAM
PINION & GEAR CUTTING MACHINES

for precision production of fine pitch mechanisms



Typical parts, produced to closest accuracy on WALTHAM Machines. All machines feature the WALTHAM method of making successive cuts with a revolving cutter



Single-Cut Pinion Machines This machine employs one cutter. Blank is positioned and machine started by hand, all other movements being automatic.

Multiple-Cut Pinion Machines Two or three cutters on arbor of cutter spindle make successive cuts. Machine stops on completion of last cut.

Magazine-Fed Pinion Machines Provides continuous production of one kind of pinion. Magazine is loaded and all other operations including cutting and ejecting are automatic and continuous.

Gear Cutting Machines Single and Multiple cut machines equipped with special cutter swing provide the means of cutting teeth on gears up to 1½" pitch diameter and in a stack ¾" to 1" long.

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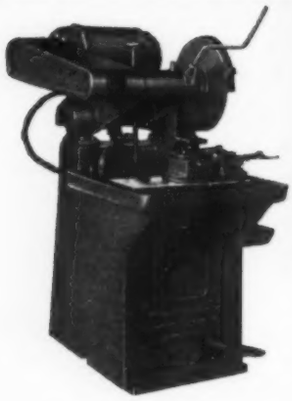
WET ABRASIVE CUT-OFF MACHINE



. . . for straight or angle cutting of practically any material used in general manufacturing . . . including such metals as brass, copper, aluminum, as well as fibrous and plastic materials in various sizes, angles and shapes.

Suitable for making straight or angle cuts in solids up to 2¼" or tubing up to 3½" diameter. Same vise is suitable for various cuts. Maximum capacity is 2¼" in cutting angles up to 45°. Graduations on table make angle-cutting fast and accurate.

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When you get set for the job with Kent-Owens Milling Machines... you can count on *steady production* without costly downtime! These machines meet today's demands for *greater speed and accuracy*... with practical features for simple and efficient operation. Ruggedly built... adaptable to a wide range of work. Write for latest bulletins. Kent-Owens Machine Company, Toledo, Ohio.

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Table travel, 28"

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ACCURATE TO .0001"

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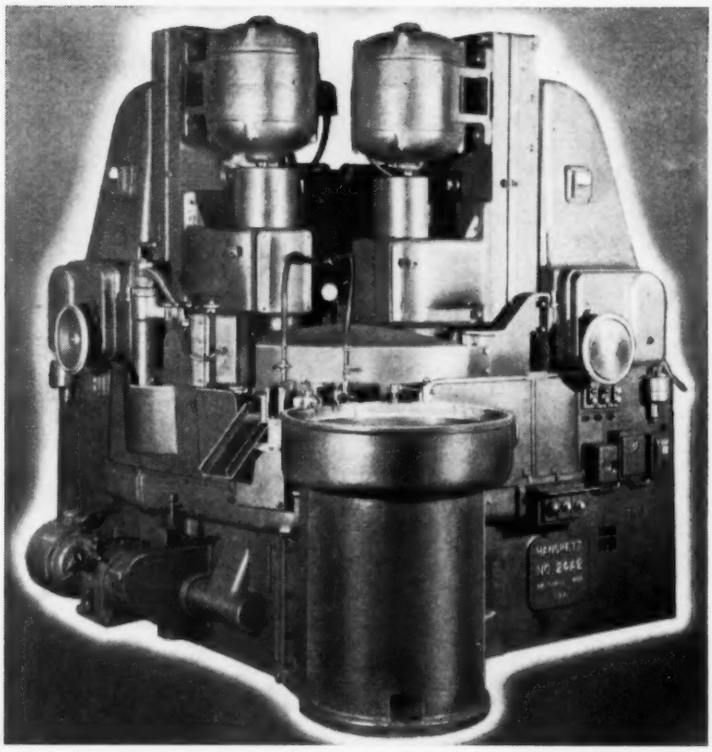
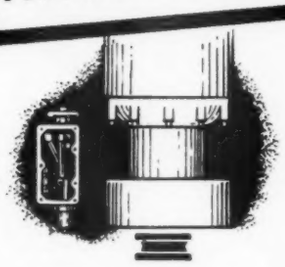
THE *Electric Arm* OF ACCURACY*

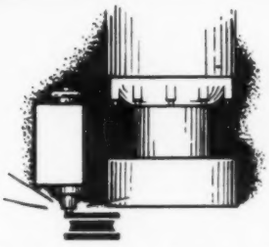
Insures Automatic Precision in HANCHETT PRODUCTION SURFACE GRINDING . . .



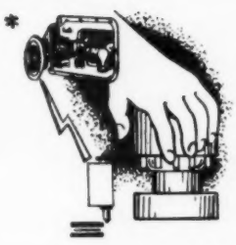
Automatic SIZE CONTROL ...How it works



OPERATION SEQUENCE: Work sizer B is in continuous contact with parts leaving grinding wheel.



As wheel wears, parts increase to allowable tolerance, closing sizer circuit.



Pre-Set control A feeds wheel down—holding tolerances without operator's attention.

Red light flashes when wheel is worn out. Ammeter offers check on grinding efficiency.

HANCHETT 24-A2 AUTOMATIC SURFACE GRINDER

Automatic size control, plus ammeters, push-button motor controls and built-in wheel dressers are a few of the reasons why Hanchett Rotary Automatics are tops for *fast* production of parts — from half-inch castellated nuts to engine blocks — with positive accuracy in the grind.

The Hanchett 24-A2 is the smallest of this series of automatic Production Surface Grinders. Up to five vertical grinding spindles can be mounted above the rotary table, to meet your requirements. Get complete information today!

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HANCHETT MANUFACTURING CO.
BIG RAPIDS, MICHIGAN U.S.A.

HANCHETT HERMETI-COIL MAGNETIC CHUCKS

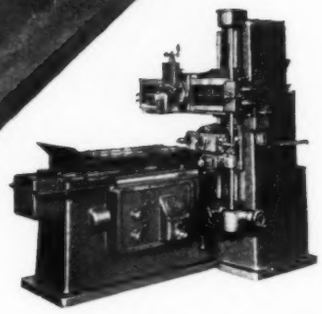
MATTISON GRINDER Holds Close Limits On 3000-Pound Base Casting 34″ High

The rugged double-column design of the Mattison Grinder certainly pays off on the job shown above. This 3000-pound iron casting, 34″ high, has two 4″ wide flat ways 74″ long. In grinding these ways the Mattison wheel-head is at the very top of its adjustment yet the surfaces ground are perfectly straight and flat within very close limits. Finish is excellent, so is grinding time of 50 minutes, floor to floor.

Other parts for Rockford Hy-Draulic Shapers, Planers, Slotters and Shaper-Planers that come to this Mattison Grinder include Tables, Saddles, Side Rails, Cross Rails, Slotter Ram Guides and Gibs in many sizes. These use the full capacity of the grinder in all directions with uniformly high production and precision on every operation.

Rugged, high powered and versatile, Mattison Grinders are capable of handling your grinding jobs on a real production basis, providing close accuracy and a fine finish.

For further information on various types of jobs ground on the Mattison Grinder, send for a copy of the latest, free, set-up book.



The Mattison grinder job illustrated is a base casting for the 36″ Openside Rockford Hy-Draulic Shaper shown above.

ADDITIONAL INFORMATION

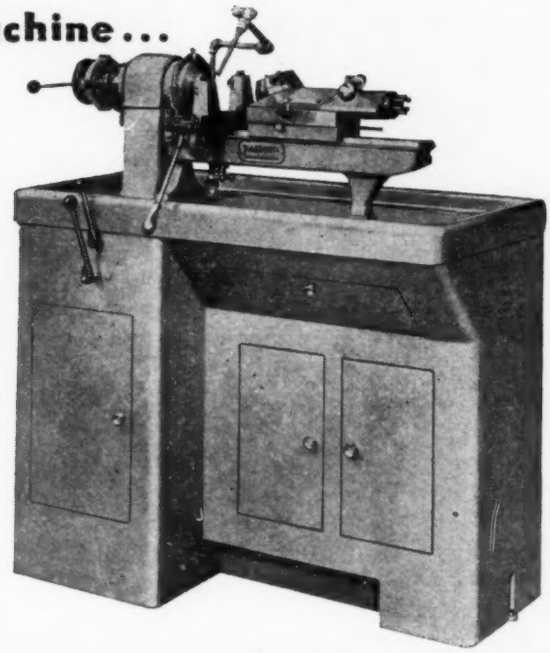
Also available is free Set-Up Book showing further examples of work ground on Mattison Grinders — Send for a copy today.

MATTISON MACHINE WORKS

ROCKFORD · ILLINOIS

ACCURACY

the machine...



the jobs...

the results...

Wade Hand Screw Machines are used on both first and second operations in producing these parts. The stock is oxygen-free copper bar, and the thin wall sections are turned to a feather edge — *.002" thick!* The parts are so accurate and so delicate that they cannot be touched by the operator during production.

Such accuracy and finish again prove our claims on Wade rigidity, because it takes the finest engineering and construction to get results like this. Wade is at your service to show how similar results can be obtained on your precision production parts. Call on them.

Wade

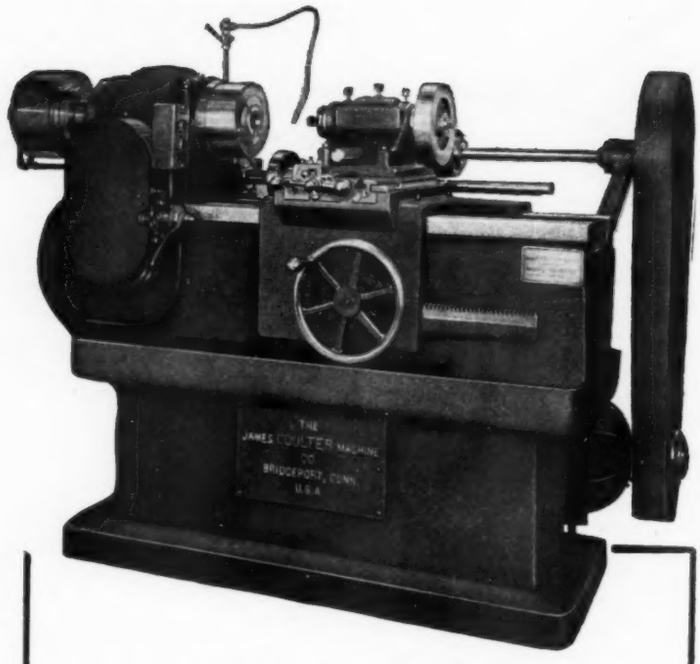
The Wade Tool Company
53 River St., Waltham 59, Mass.

Keep Ahead of
POSTWAR DEMANDS
on the PRODUCTION of
EXTERNAL and INTERNAL THREADS

The Coulter Type "H" Hob Thread Miller—modern in every detail of design and construction—handles high speed, accurate production of right or left hand threads. Any parts that can be held in ordinary chucks, air operated chucks, air operated collet chuck or special face plate fixture can be threaded on this machine.

Work holding spindle and cutter spindle are driven by individual motors through worm and gears. Speed changes to work spindle are accomplished by pick-off gears; cutter spindle speeds are controlled by variable motor sheave. All high speed shafts turn in anti-friction bearings.

Maximum external thread, 7"; minimum hole depends on smallest hob practical.



Send for Descriptive Bulletin giving full information.

The James COULTER *Machine Co.*
BRIDGEPORT • CONNECTICUT • U.S.A.

GREAVES No. 2
PLAIN or UNIVERSAL MILLING MACHINE
. . . for Speed, Accuracy, Production and Tool Room Work . . .

featuring:

- Power Feeds, all Directions
- Rapid Traverse—6-way
- Alloy Hardened Gears
- One Shot Lubrication to Table, Saddle Slides and Screws
- All Speed and Feed Changes through Positive Gearing
- All Speed and Feed Gearing run in Oil
- Timken Bearings
- Glass Sight Oil Control
- Unit Construction
- Central Control Position for all Operation Levers
- Coolant System

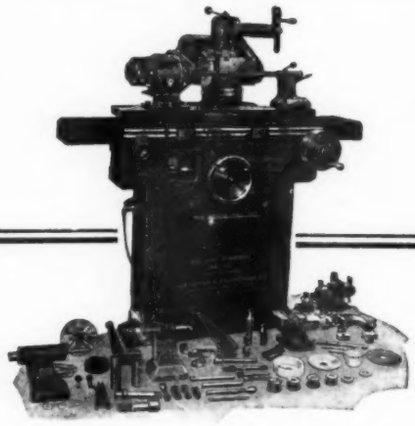
Specifications

Table—52¼" x 12"
Feed range—Longitudinal Power Feed 28"
Cross Power Feed 10"
Vertical Power Feed 19"
Overarm—4½" diameter
Spindle—Chrome nickel steel National Standard taper hole #50
Speeds—18—Range 20-1000 RPM Reverse on all speeds
Feeds—9—Range ½" to 18" per minute
Rapid traverse—Longitudinal—cross and vertical—All directions—75 per minute
Weight—3750 lbs.

Send for illustrated literature giving complete information.
Write for nearest agent or dealer

Exclusive Distributors

H. LEACH MACHINERY CO.
387 CHARLES STREET PROVIDENCE, R. I.



GRAND RAPIDS NO. 60
UNIVERSAL CUTTER AND TOOL GRINDER

featuring:

- modern cabinet base
- hardened and ground table ways
- ball bearing table
- fixed table height
- one shot lubrication
- and many other important features

Illustrated Catalog containing complete details sent promptly on request.

GALLMEYER & LIVINGSTON CO.
330 STRAIGHT AVENUE
GRAND RAPIDS (4), MICH., U.S.A.

DON'T *miss this great event!*

Everything points to the greatest industrial event in history as plans are completed for the 27th National Metal Congress and Exposition the week of February 4 in Cleveland's big Public Auditorium.

400 manufacturers are on the way to Cleveland with the newest developments in production equipment, metals and materials, processes and techniques.

Hundreds of industrial leaders have completed scores of talks, educational lectures and round-table discussions on subjects that range from the super-alloys required to harness atomic and rocket power to the latest methods of spraying, welding, induction brazing, testing, etc.

Big . . . fast-moving . . . interesting — you will want to see and hear the thousand-and-one news-making developments that will be concentrated for your convenience during the week of this great Metal Show.

Plan to attend. Talk to your friends and associates. Organize group visits from your office or plant. But by all means, get to Cleveland for this show. DON'T MISS THIS GREAT EVENT!

NATIONAL METAL CONGRESS AND EXPOSITION

FEBRUARY 4TH THRU 8TH

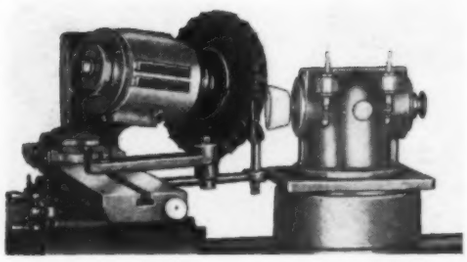
CLEVELAND'S PUBLIC AUDITORIUM

For The Tool Man

WHO INSISTS ON PRECISION

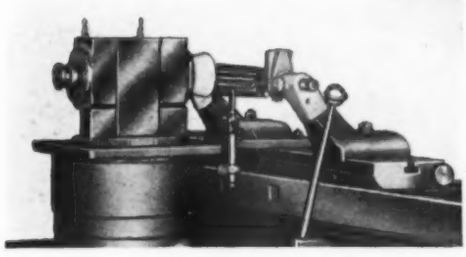
Plus

CAPACITY and VERSATILITY



LARGE FACE MILL GRINDING

These operations require the rugged, precision-built performance of the No. 22.



GRINDING TAPERED REAMERS "UNiVERSAL"

An example of the No. 22's range of cutter and tool grinding operations.

FORM TOOL SHARPENING

Wheel elevation of 7½" is sufficient to accommodate most lathe or form tools.

No. 22 UNIVERSAL CUTTER *and* TOOL GRINDER

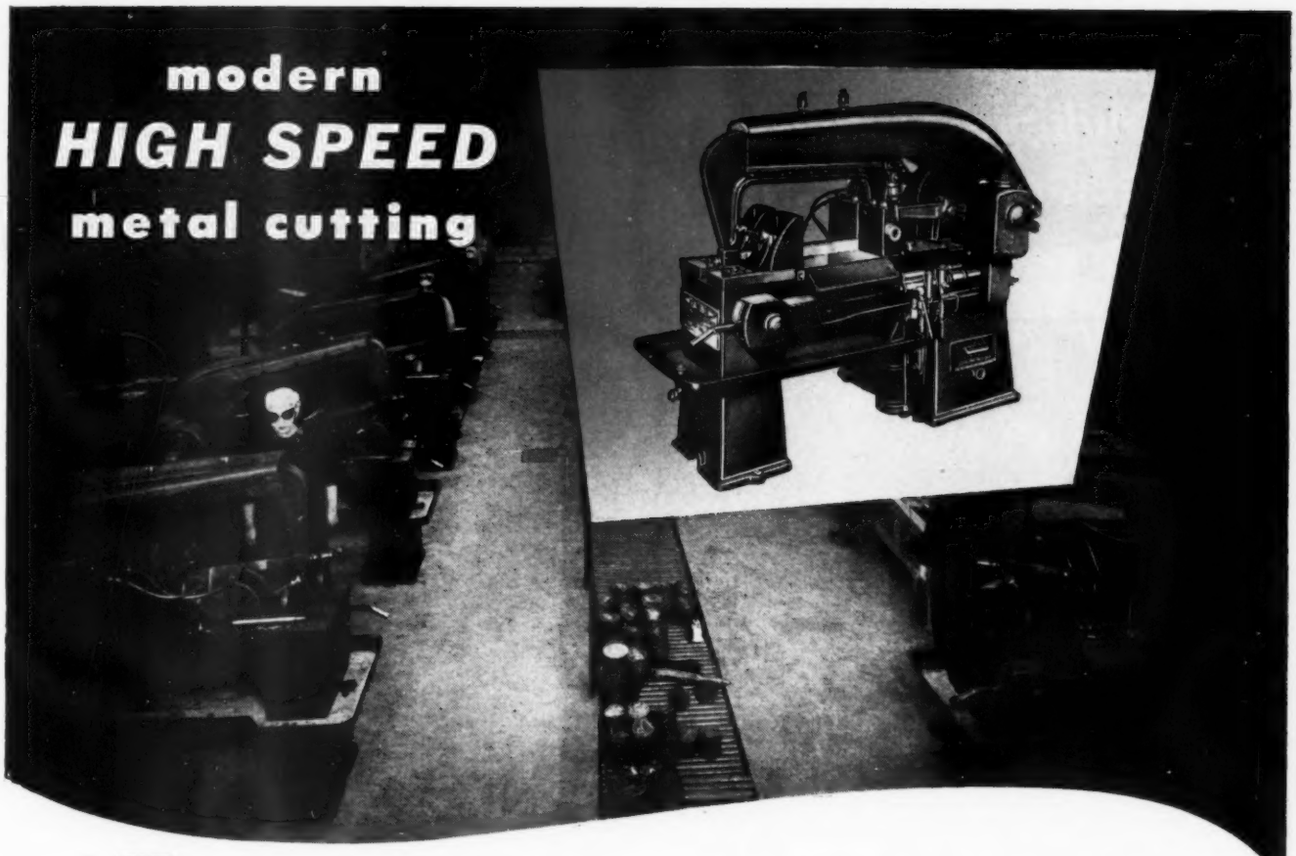
IMMEDIATE DELIVERIES

See Your Nearest Dealer or Write For 20-Page Bulletin AM-36

GRINDING MACHINERY SINCE 1874

COVEL INDUSTRIAL GRINDERS

COVEL MFG. CO., BENTON HARBOR, MICHIGAN U. S. A.

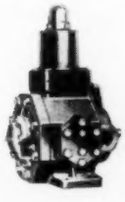


That lowers production costs

Here is modern high speed metal cutting—with greatest efficiency —at the start of a great production line. This battery of Racine heavy duty Hydraulic metal cutting Machines in a prominent midwestern steel mill, is speeding up the plant capacity.

These smooth, powerful hydraulic Machines save time and material. Their accuracy reduces the cost of subsequent machining operations—all factors in helping you meet the post war need for maximum efficiency, increased output, lower costs.

A complete series of Machines from 6″ x 6″ to 20″ x 20″. Get our catalog No. 12. Also ask for Free production estimates on your specific work. Write today.



RACINE OIL HYDRAULIC PUMPS AND VALVES

Consider Racine *Variable Volume* Pumps and Racine Valves for your oil hydraulic circuits. Pump 0 to 30 G.P.M. Operating pressures 50 to 1000 lbs. p.s.i. Valves in all sizes from ⅜″ to 1½″ I.P.S. Full information in our catalog P-10-C. Write.

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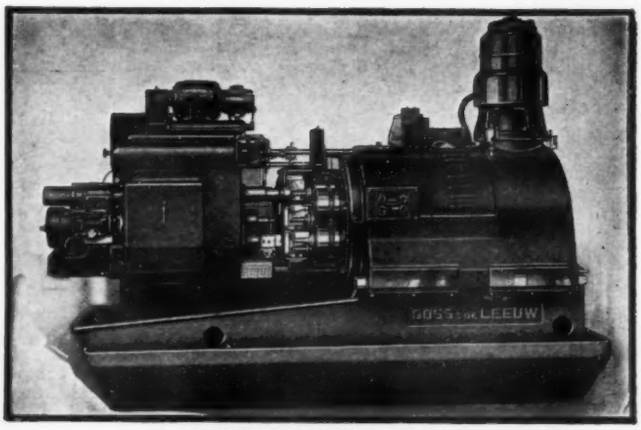
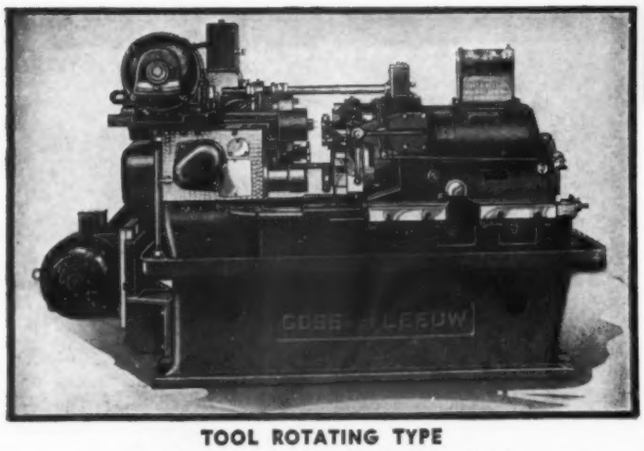
Standard for Quality and Precision

GOSS & DE LEEUW
Multiple Spindle
CHUCKING MACHINES



WORK ROTATING TYPE

5 Spindles • 6 Spindles • 8 Spindles



TOOL ROTATING TYPE

4 Spindles • 5 Chucking Positions

Both types of machines provide lead screw threading. Oversize spindles on these machines are mounted on pre-loaded anti-friction bearings. Ways are hardened; gears are of chrome-nickel steel, carefully heat-treated.

The many modern features offered in these machines are fully described in catalog available on request.

GOSS & DE LEEUW MACHINE CO., NEW BRITAIN, CONN.

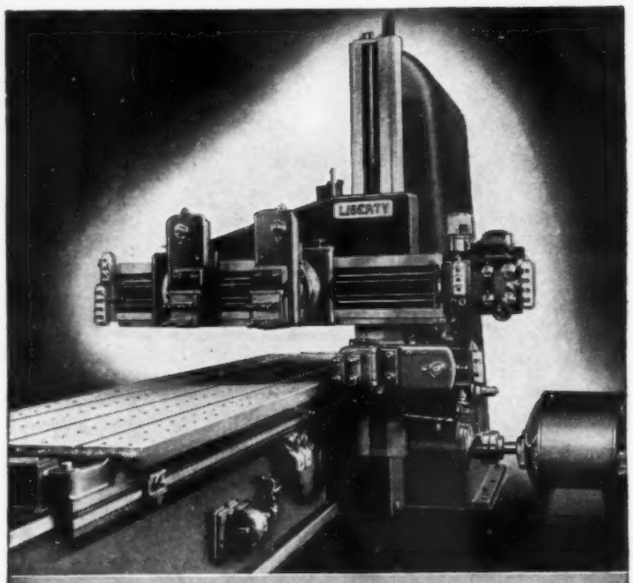
PORTAGE

HORIZONTAL BORING, DRILLING AND MILLING MACHINE NO. 4

• Featuring an extended saddle and table with outer rail support for maintaining exceptional accuracy on long work. Get fully acquainted with the many features of this modern Boring Mill. *Ask for a copy* of our new instructive bulletin which points out the numerous advantages of this new Horizontal Boring, Drilling & Milling Machine.

THE PORTAGE MACHINE CO.

AKRON 11, OHIO



LIBERTY

SMALL, MEDIUM AND HEAVY DUTY

PLANERS

FOR HIGH SPEED, LOW COST PRODUCTION

LIBERTY PLANERS • HAMILTON, OHIO, U. S. A.

Quarter Century of Specialized Experience with Time Tested Principles of Design

Welding Research That *Keeps Pace* with Every Advance in Metallurgy

1927 A. O. Smith has always been alert to the possibilities of new alloys and new metals. When stainless steel was produced, SMITHway welding laboratories promptly developed a stainless steel electrode coating. The result was a weld that preserved all of the new alloy's corrosion-resistant properties.

1946 Welding research that has been continuous since 1917 stands behind the virtually constant flow of stainless vessels from A. O. Smith plants. Constructed in all sizes, often of intricate design, and made of solid alloy or with stainless linings, SMITHway Welded Pressure Vessels are in high-corrosion service the world around.

Not The Proof Is in Production . . . The Proof Is in *Service*

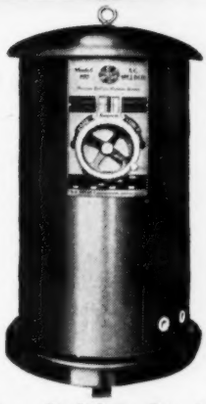
A stainless steel electrode may have all of the necessary physical properties, it may be a delightful tool for the welder to use, it may even cost less than half of some other electrode—but it may be a disastrous investment for the fabricator if it fails after months or even years of service.

That's why SMITHway *Certified* Electrodes are specified for most "particular" jobs. Large volume operators recognize that there is no substitute for the extensive A. O. Smith laboratories in controlling and maintaining the *chemistry* as well as the *metallurgy* of stainless steel electrode metal. And large volume operators take no chances that a ten-cent economy today may cause a thousand-dollar failure in service two years, five years, or even ten years from now.

For detailed specifications of SMITHway Certified Electrodes and their application to specific welding jobs, send for the SMITHway Welding Catalog.

SMITHway A. C. Welders a Complete Line

Six models, including three new models of 150-, 200-, and 250-ampere capacity. Heavy Duty Models of 300-, 400-, and 500-ampere capacity. Write for complete specifications and prices.



Mild Steel...High Tensile...Stainless Steel WELDING ELECTRODES

made by welders for welders

SMITHway Certified WELDING ELECTRODES

A. O. SMITH Corporation

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THIS NEW *Broach Tooling Service* ELIMINATES TRY-OUT TROUBLES

IN addition to a staff of competent field engineers to help you set up your broaching job and get it running, Detroit Broach Company offers a new service. We are now prepared to set up your machine here at our plant, try it out and then ship it to you ready to run. Your job will be set up by men who know broaching from start to finish so that when the tooled-up machine arrives at your plant it is ready to go into production without delay.

Detroit Broach Service is complete. It includes recommending equipment and methods, tool and fixture design and manufacture, set-up and try-out, field service and contract broaching on our own machines. Let Detroit Broach engineers prove the efficiency and economy of this modern metal-cutting method by giving you actual cost and production figures on your own job.

ARMY NAVY

MEMBER BROACHING TOOL INSTITUTE

DETROIT *Broach* COMPANY

20201 SHERWOOD AVENUE · DETROIT 12, MICHIGAN

How to Cut Costs in PRODUCTION DRILLING

STANDARD BARNESDRIL HYDRAMS CAN BE TOOLED FOR HIGH SPEED, PRECISION DRILLING, BORING AND REAMING OPERATIONS

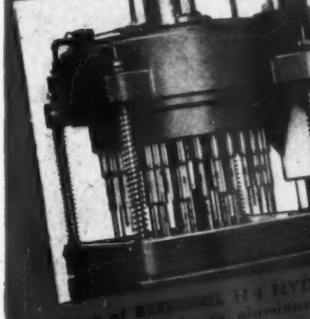
BARNESDRIL Self-Oiling Hydraulic HYDRAMS—well proportioned units of tremendous strength, rigidness and power—will give you the most economical method for high production in drilling, boring reaming and facing operations.

Original in design with BARNESDRIL, the hydraulic cylinder carrying the ram and the spindle are placed so as to bring the feeding pressure directly above the work. BARNESDRIL HYDRAMS are extremely versatile units for both *general-purpose drilling*, using multiple speeds and infinite feeds, and for *production drilling*, with multiple spindles or special tooling arrangements. The convenient feature of interchangeable heads permits the same machine to be used on a wide range of drilling, reaming, boring and facing work on several different parts.

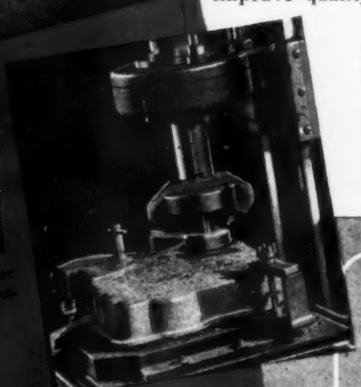
Hydraulic control permits the machining cycle of automatic rapid approach, feeding rate, hydraulic dwell for facing (when so equipped), and quick automatic return. Faster or slower feeding rates are instantly available through a volume regulator.

For diversified high production drilling, reaming, boring, and facing work, BARNESDRIL HYDRAMS have the mechanical efficiency, power, speed and productive capacity to lower machining costs and improve quality.

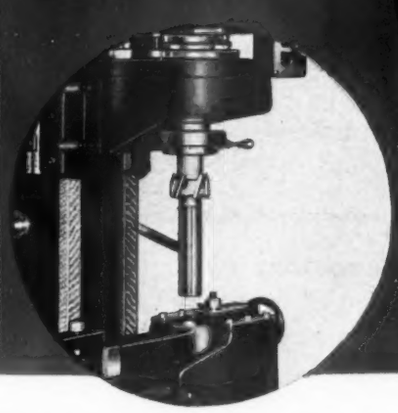
Have BARNESDRIL engineers analyze your production drilling problems. They will assist you in determining the correct machine and the proper tooling for your particular machining requirements. Send part prints and complete data for recommendations on how your work can be profitably produced on BARNESDRIL HYDRAMS. There is no obligation.



Setup of BARNESDRIL H-4 HYDRAM for drilling 56 holes in aluminum housing.



Close up of tooling on a BARNESDRIL H-3 HYDRAM for rough and finish milling of engine support bearing. Mill is equipped with two cutting tools, one roughing and one finishing.



View of single-spindle BARNESDRIL H-3 HYDRAM for boring small end of large Diesel engine connecting rod.

BARNESDRIL HYDRAM Drilling, Reaming, Boring and Facing Machines are available in three sizes.

The H-2 HYDRAM has a drilling capacity of 2" diameter in any material.

The H-3 HYDRAM will drill up to 3" in diameter in any material.

The H-4 HYDRAM has a 4" diameter capacity in solid drilling, while cast-iron can be bored and reamed up to 8" in diameter.

These single spindle, general-purpose drilling machines can be provided with multiple spindle heads for drilling many and different sizes of holes with one pass of the machine.

Ask for Bulletin A 134 which gives the features, advantages and specifications of BARNESDRIL HYDRAM Self-Oiling Hydraulic Drilling, Boring and Reaming Machines. Actual jobs performed on these machines are described in detail.

Barnes Drill Co.

830 CHESTNUT STREET

ROCKFORD ILLINOIS, U. S. A.

BURKE MILLING MACHINES

. . . Put Your Small Work on a Production Basis!

Those small, difficult jobs can be handled on a *production basis* with BURKE Motor Driven Milling Machines Nos. 1, 2, 3, & 4. Primarily, this is because BURKES have been *specially designed and built* to do smaller milling jobs efficiently and economically.

Then, too, a number of attachments are available . . . attachments that increase the units usability, and add to your productivity. These include a vertical milling attachment, index centers, and vises—3 types, including swivel base. Now, when production must be stepped up, is the time to investigate the profit possibilities of BURKE Milling Machines, as applied to your work.

Complete Information Will Be Sent You Upon Request — Write!

BURKE MACHINE TOOL CO.
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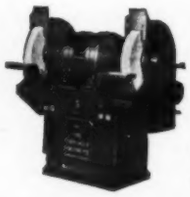
There's A "HISEY" GRINDER FOR YOUR GRINDING NEEDS

From the smallest bench grinder to the largest foundry snagging grinders you will find a Hisey that will efficiently fit your particular grinding needs.

Write now for complete catalog 70K

Heavy Duty Drill Grinder

Tex Drive Buffing and Polishing Machine



Heavy Duty Tex Drive Snagging Grinder

Heavy Duty Floor Grinder

Hisey THE HISEY-WOLF MACHINE CO.
CINCINNATI, OHIO.

MILLHOLLAND

Automatic DRILLING - BORING MILLING - TAPPING *Units*

½ to 20 HORSEPOWER DRIVE

AUTOMATIC and SEMI-AUTOMATIC PRODUCTION MACHINERY

W. K. MILLHOLLAND MACHINERY CO.
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PRODUCTION ENGINEERS
at these Branch Offices will help you with your
DRILLING PROBLEMS.

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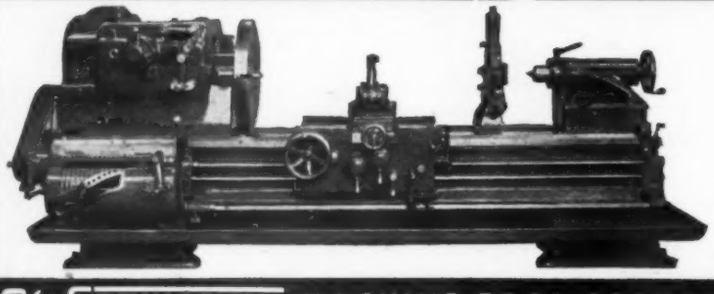
SPRINGFIELD GEARED HEAD LATHES



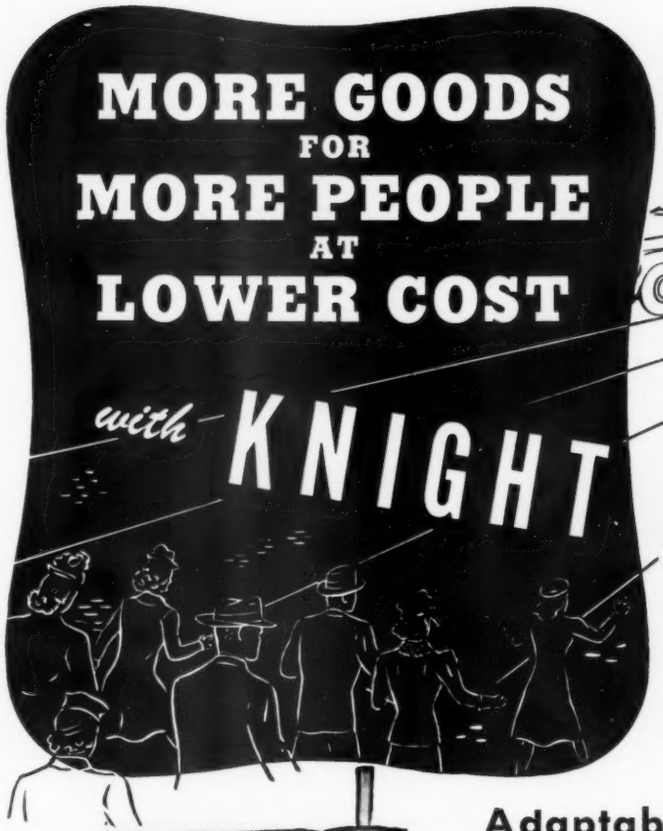
for peacetime or war production!

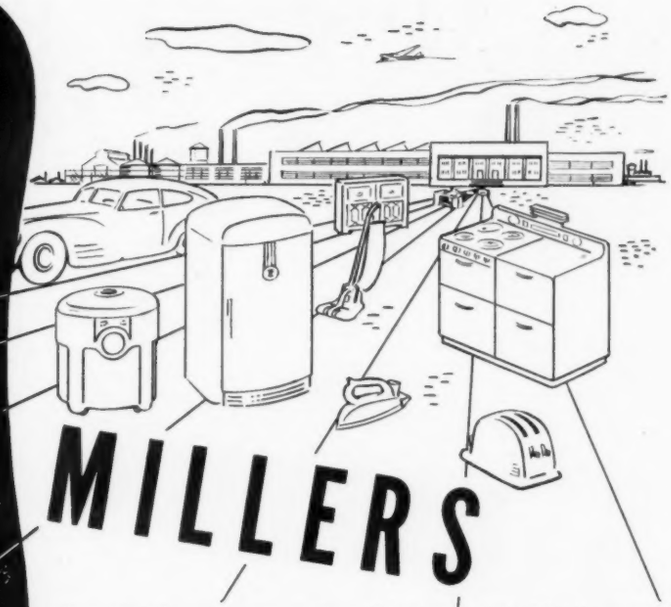
A lathe purchased now, for round-the-clock war production, must still meet peacetime requirements. Therefore, specify SPRINGFIELD lathes —flexible, efficient, ideal for emergency or normal production. SPRINGFIELD lathes are built in sizes from 14" to 30". Write for descriptive bulletins, prices, deliveries, etc.

The SPRINGFIELD MACHINE TOOL COMPANY • • • SPRINGFIELD, OHIO, U.S.A.

MORE GOODS FOR MORE PEOPLE AT LOWER COST

with KNIGHT MILLERS





Contributing, for more than 35 years, notable time and dollar economies in the production of more and better goods, these features, engineered and built into Knight Millers, offer you exceptional opportunities to increase output and reduce cost:

Adaptability... to a wide range of difficult or out-of-the-ordinary work enables Knight Millers to perform jobs that often require two or more machines.

Flexibility... Knight's tilting, swiveling table is universal in scope, and eliminates the use of costly special jigs and fixtures.

Capacity... Increased working area, and the use of an unusual range of cutter sizes, are provided by sixteen changes of spindle and table speeds and feeds, four vertical spindle feeds, and the swiveling table.

Speed... Reduced setup time, elimination of special setups, fast changing of cutting tools, quick locating, all mean sizeable economies in time.

Accuracy... Sturdy one-piece reinforced column, wide and accurate bearing surfaces, precision gearing and rigid supports, insure accuracy, smooth operation and rugged service.

Learn how Knight Millers can help you produce more goods for more people at lower cost.

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KNIGHT VERSATILE MILLERS ACCURATE RIGID

W.B.KNIGHT MACHINERY COMPANY

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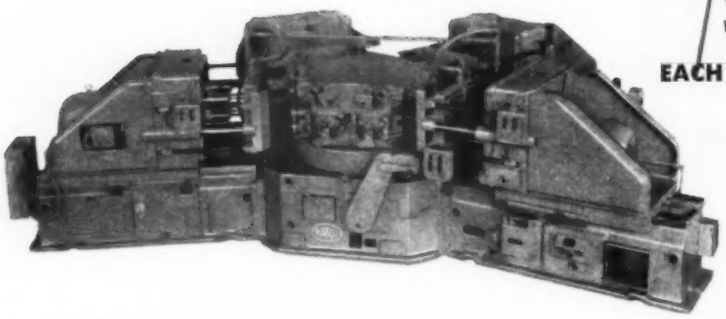
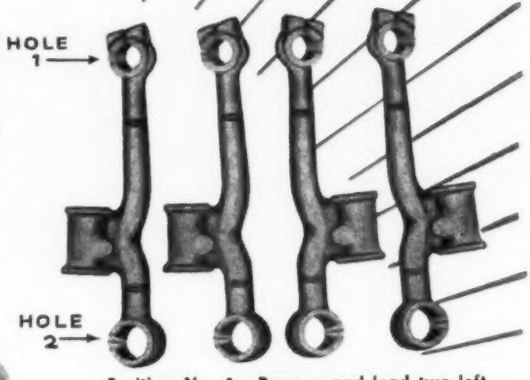
NATCO SEQUENCE MACHINE

Producing!

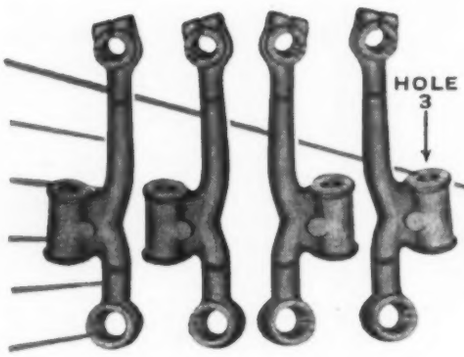
236 Steering Knuckle Supports

EACH MACHINE EACH HOUR



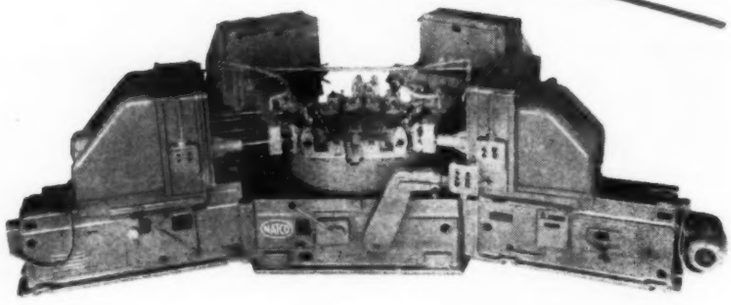


Position No. 1—Remove and load two left hand parts and two right hand parts.
Position No. 2—Drill holes No. 1 and No. 2 in each of four parts.
Position No. 3—End cut ream holes No. 1 and No. 2 in each of four parts.
Position No. 4—Chamfer both sides of holes No. 1 and No. 2 in each of four parts.
Position No. 5—Finish ream holes No. 1 and No. 2 in each of four parts.



NATCO

Position No. 1—Remove and load two left hand parts and two right hand parts.
Position No. 2—Drill hole No. 3 one half way through in each part.
Position No. 3—Drill hole No. 3 through in each part.
Position No. 4—End cut ream hole No. 3 in each part.
Position No. 5—Finish ream hole No. 3 in each part.



The NATCO SEQUENCE HOLESTEEL machines illustrated above have already begun producing consumer products in our vast reconversion program. These with many other NATCO'S will change our metal working industries from the efficient war material producing factories of the past several years to the just as efficient consumer product producing factories of the future.

Your plans for the future of your HOLE business should include drilling, boring and tapping equipment, engineered to reduce operator fatigue, increase efficiency, lessen scrap and maintain required tolerances. With NATCO drilling, boring and tapping machines, these desirable necessities are assured, backed by our many years of "KNOW HOW."

Contact your nearest representative for solution to your drilling problems.

NATCO Solves Your "HOLE" Problems.

National Automatic Tool Company, Inc., Richmond, Ind.

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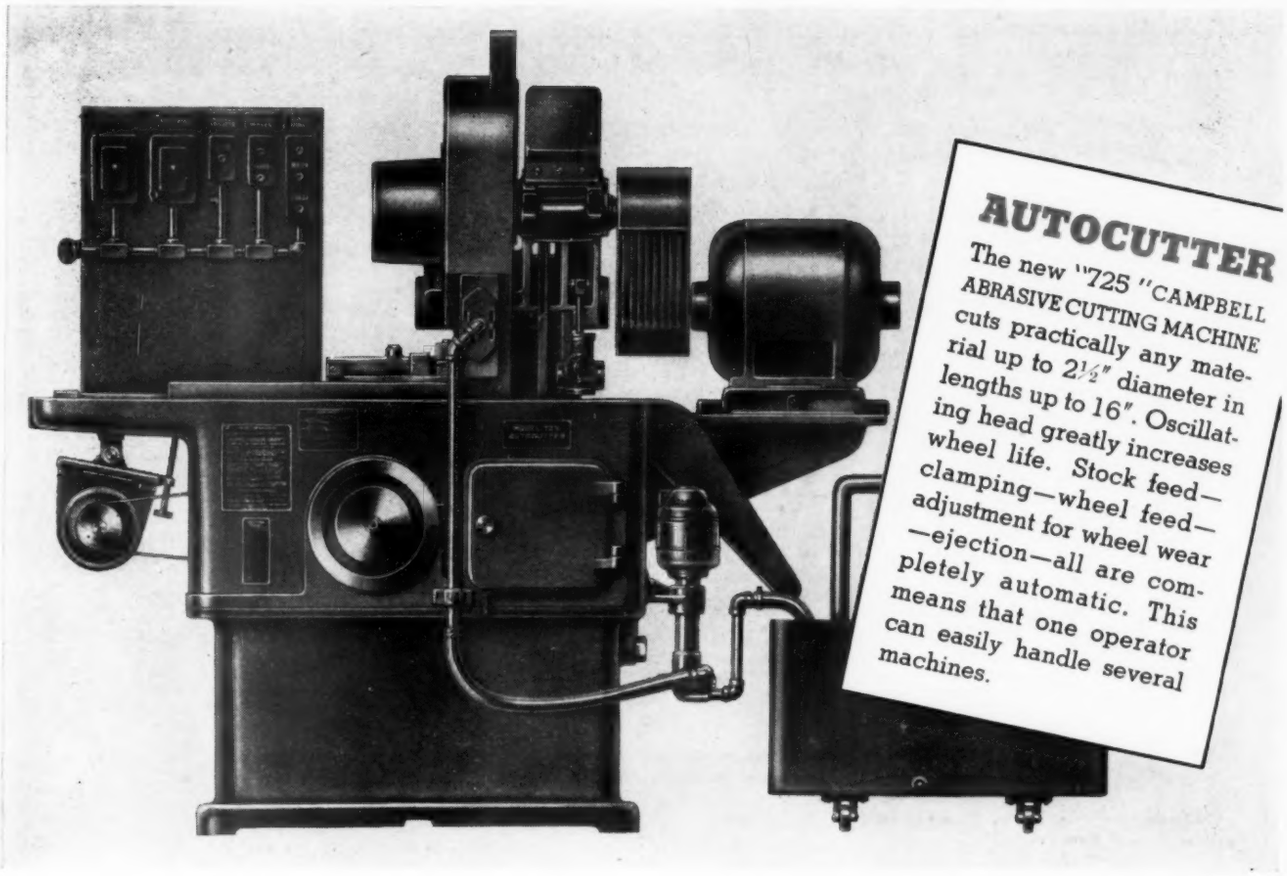

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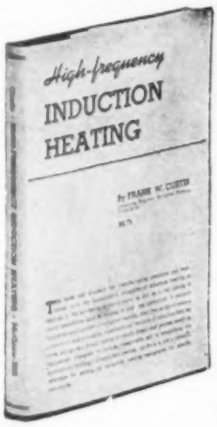

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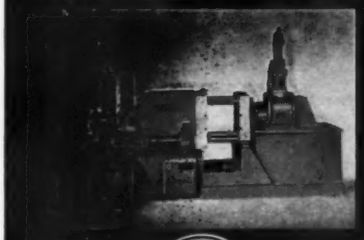

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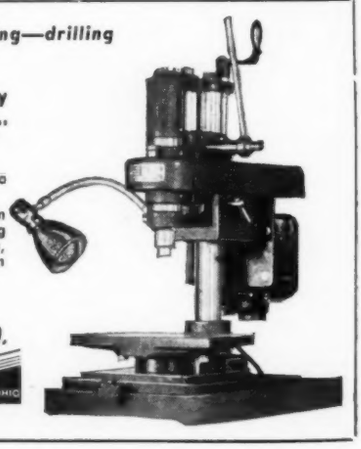

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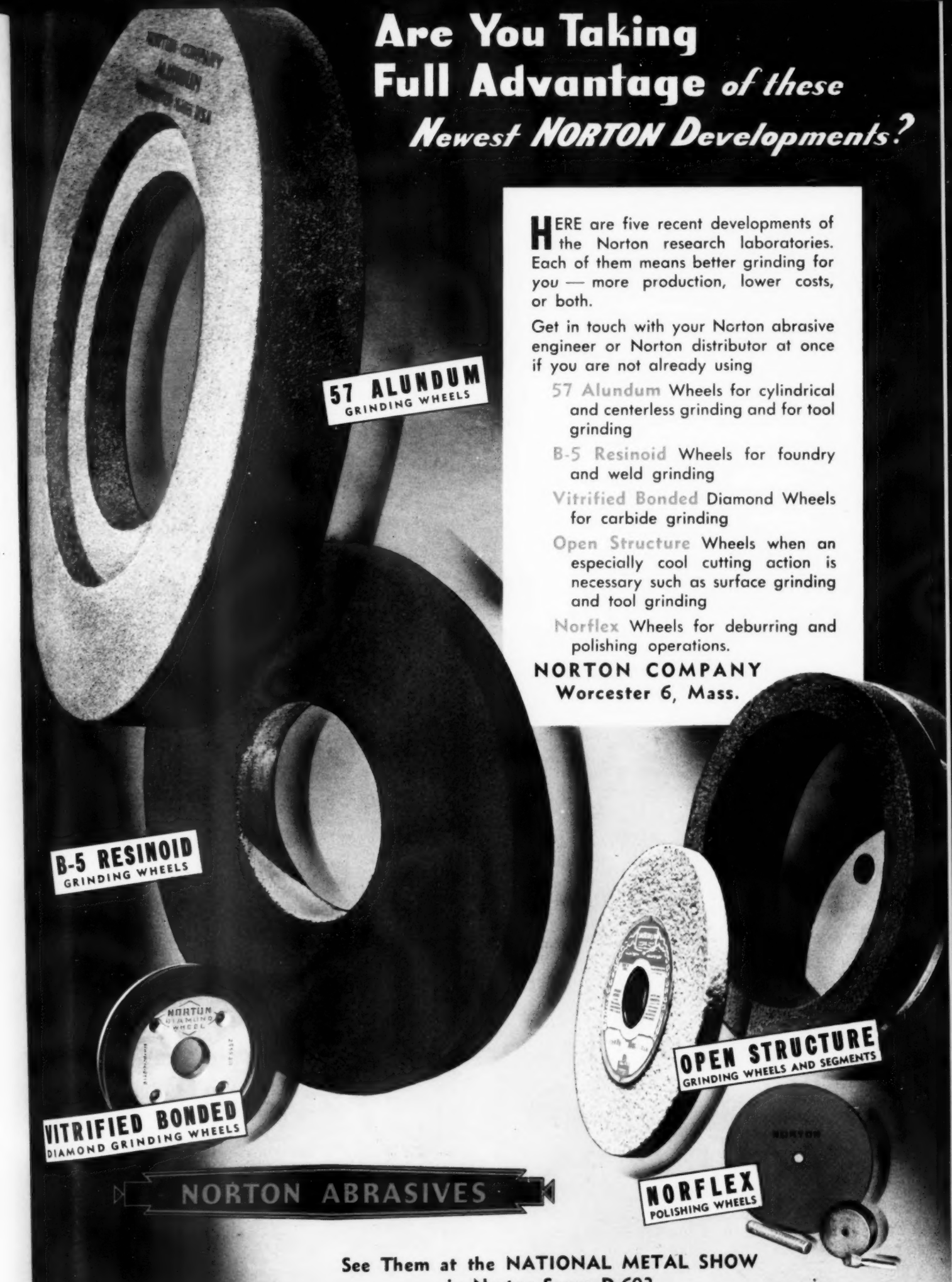

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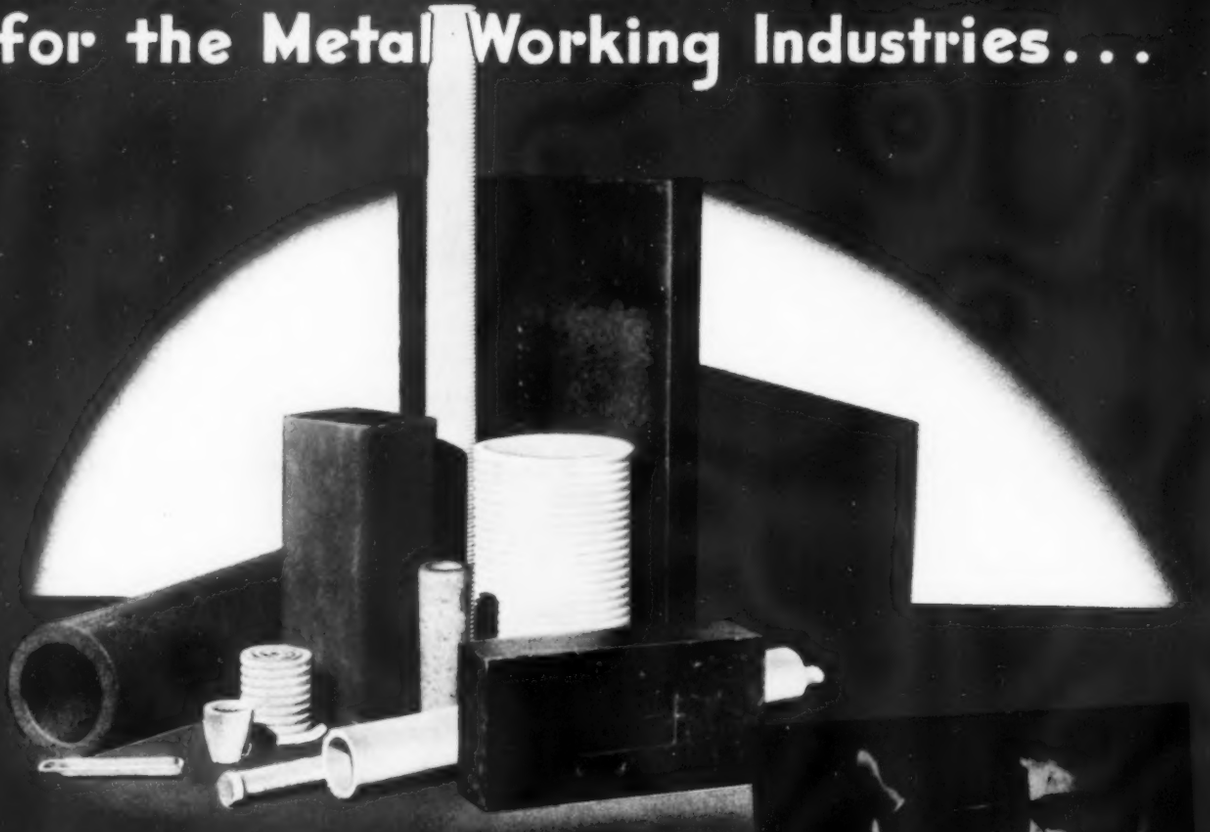

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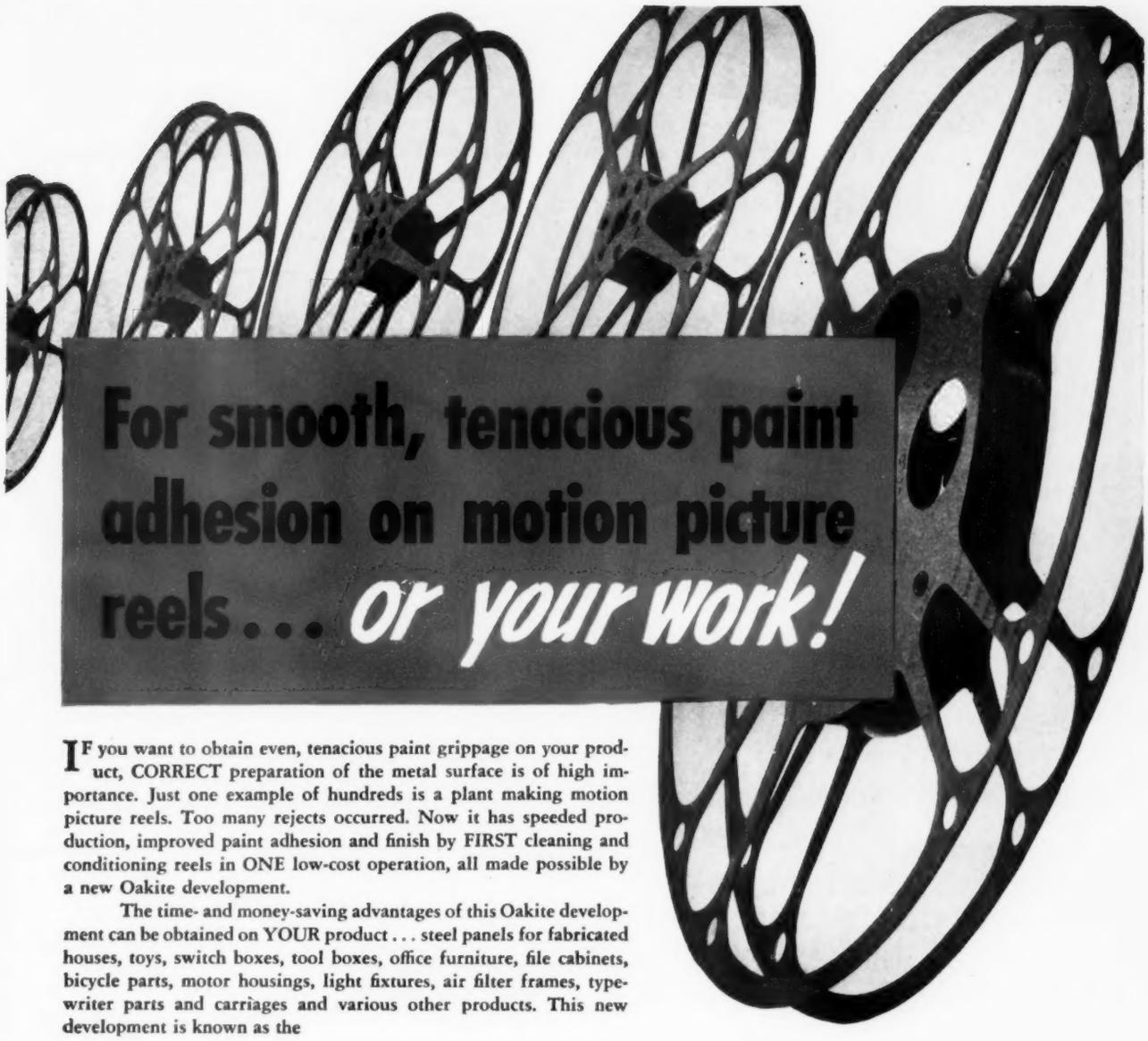

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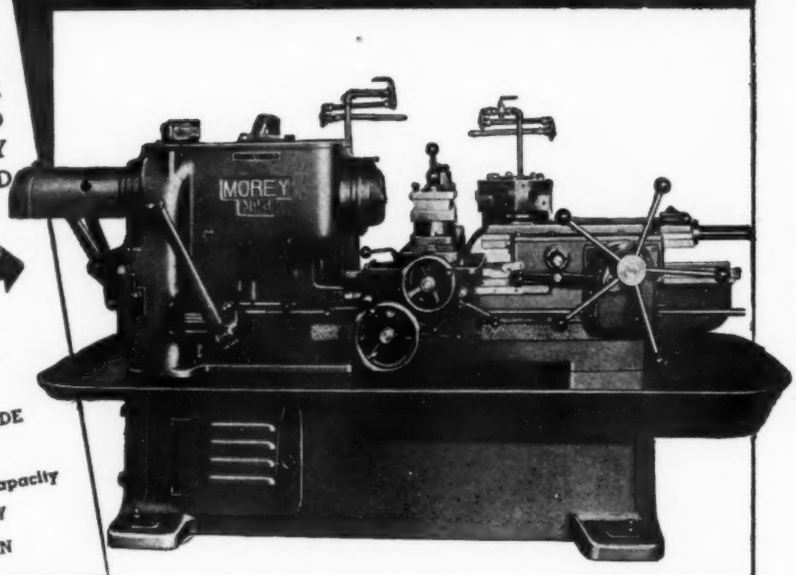

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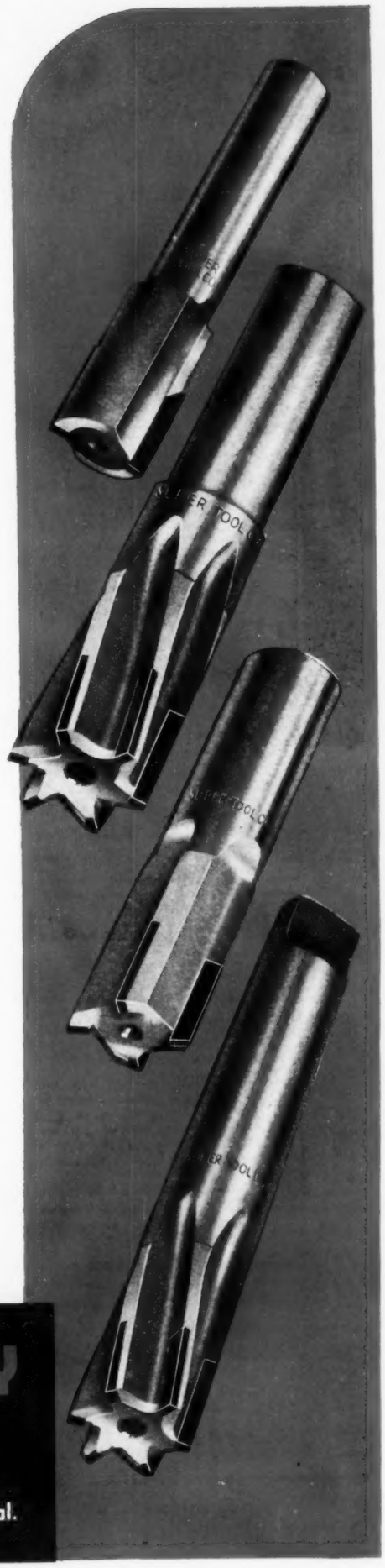

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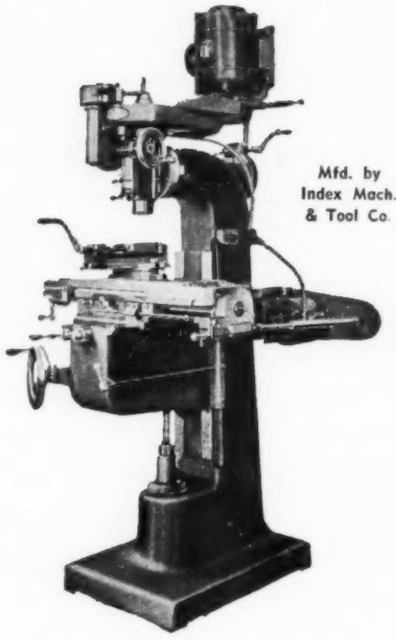

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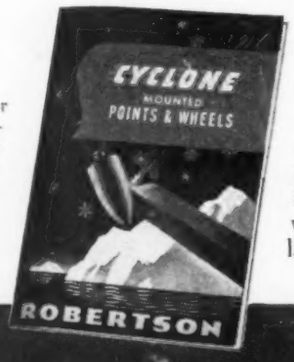

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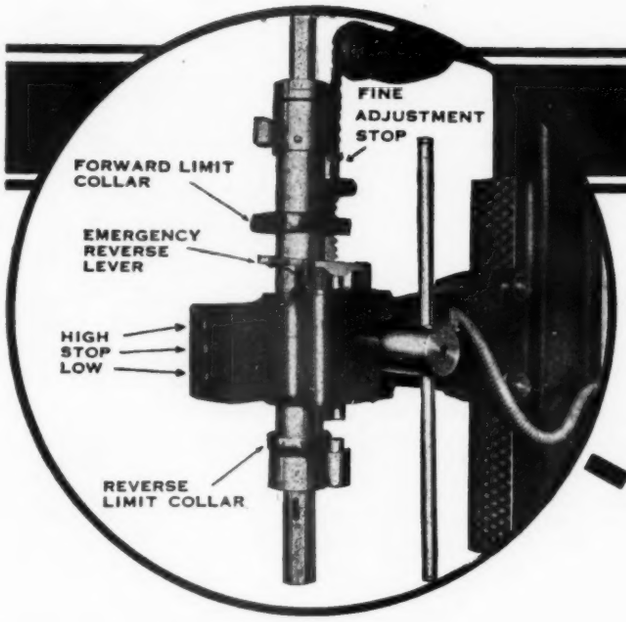

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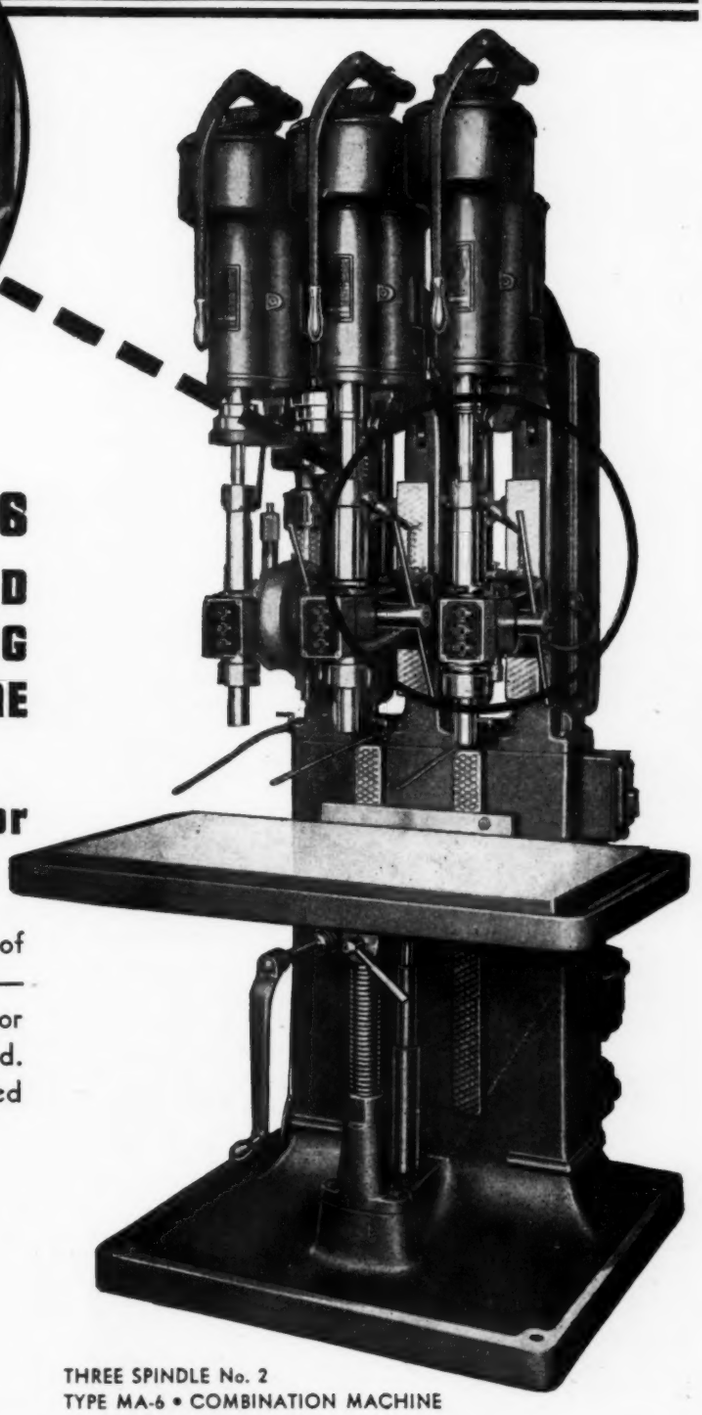

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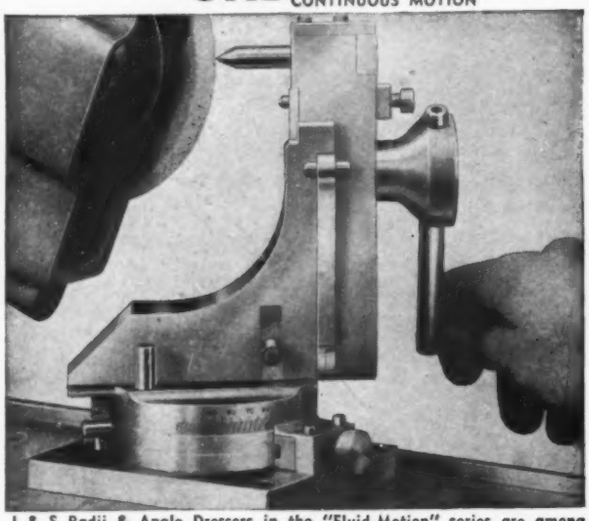

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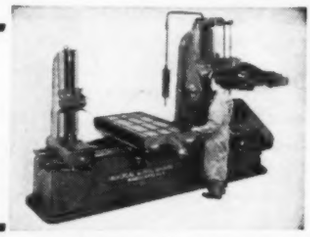

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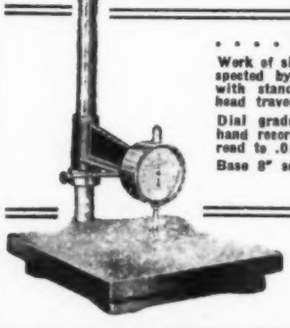
Platform Gauge



. . . . takes work up to 7 inches

Work of similar size can be quickly and easily inspected by setting gauge head at desired height with standard block or plug. Spindle on gauge head travels ½".

Dial graduated 0 to 50 in thousandths; second-hand records 10ths of inches. Can be furnished to read to .01 mm.

Base 8" square; height 13"; weight 18½ lbs.

Investigate Now!

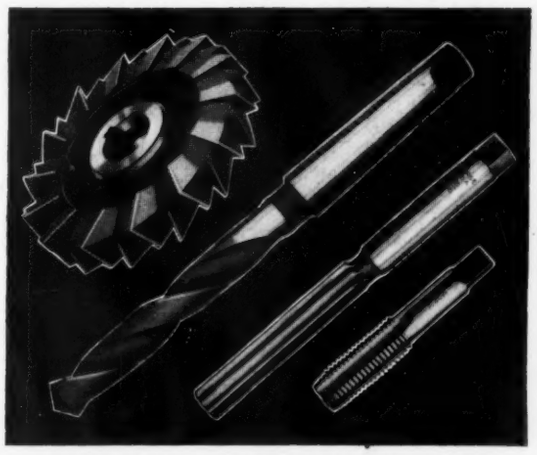
FRANK E. RANDALL CO.
Waltham 54, Mass.

TAKE A SHORT LOOK

AT THIS LONG CHIP

...and you'll see why Morse Tools cut costs so consistently!

To produce chips like these, drills must be precision-made . . . be accurately ground . . . have uniformly-dimensioned, uniformly-angled cutting edges, always with proper lip clearance. Obviously, that's how Morse Drills *are* made. That's why there's less spoilage, less down-time . . . that's why costs usually drop . . . when plants start using Morse Drills. Start using Morse Tools yourself!



TO REDUCE COSTS, SPECIFY MORSE CUTTING TOOLS . . AS ALWAYS — THROUGH DISTRIBUTORS

MORSE

THERE *IS* A DIFFERENCE

TWIST DRILL AND MACHINE COMPANY
NEW BEDFORD, MASS., U. S. A.

NEW YORK STORE: 130 LAFAYETTE ST. • CHICAGO STORE: 570 WEST RANDOLPH ST. • SAN FRANCISCO STORE: 1180 FOLSOM ST.

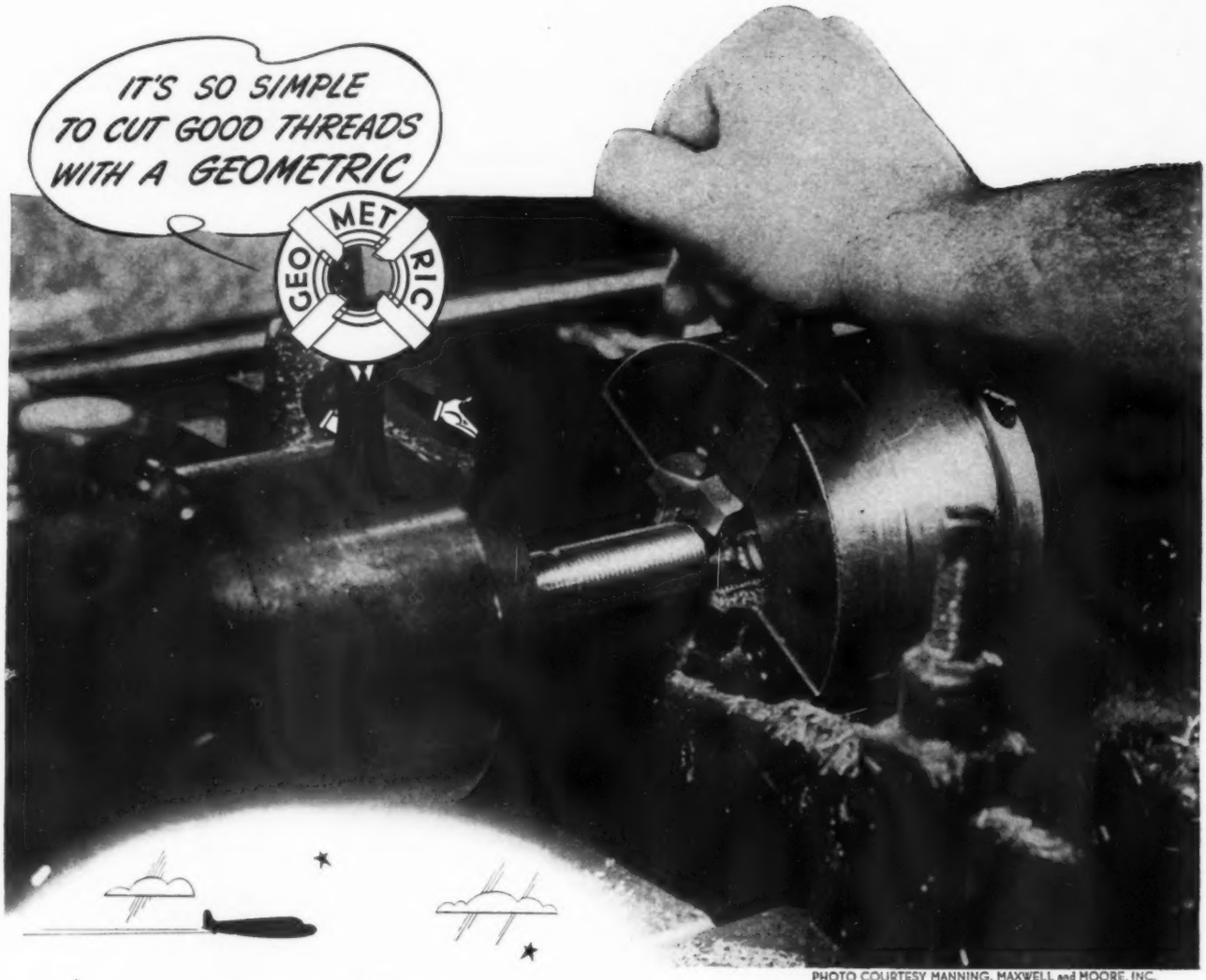


PHOTO COURTESY MANNING, MAXWELL and MOORE, INC.
BRIDGEPORT WORKS

Threads for the New Age by GEOMETRIC

On the screw machines of today are being cut the threads of tomorrow — threads that will be used in the mechanized products of a new age. And whatever the threading job, you'll find Geometric Die Heads giving precise, rapid performance. The sturdy $1\frac{1}{4}''$ Style "D", Self Opening Geometric Die Head shown in the above photograph (cutting a $\frac{7}{8}''$-14 NF thread on a Compression Screw for a Steam Valve) is typical of thousands in use all over the world. This particular Die Head cuts threads from $\frac{1}{2}''$ to $1\frac{1}{4}''$ while the entire Style "D" line cuts threads from $\frac{1}{8}''$ up to $3\frac{1}{2}''$.

FOR NEARLY EVERY THREADING JOB—A GEOMETRIC!

If you have in mind a particular threading problem, we will be glad to have our engineers give you their recommendations, based on over a half century of specialization in this field. Why not let us send you the latest Geometric catalog?

THE
GEOMETRIC
TOOL COMPANY . . NEW HAVEN 15, CONN.
A Division of Greenfield Tap and Die Corporation

WHEN YOU BUY

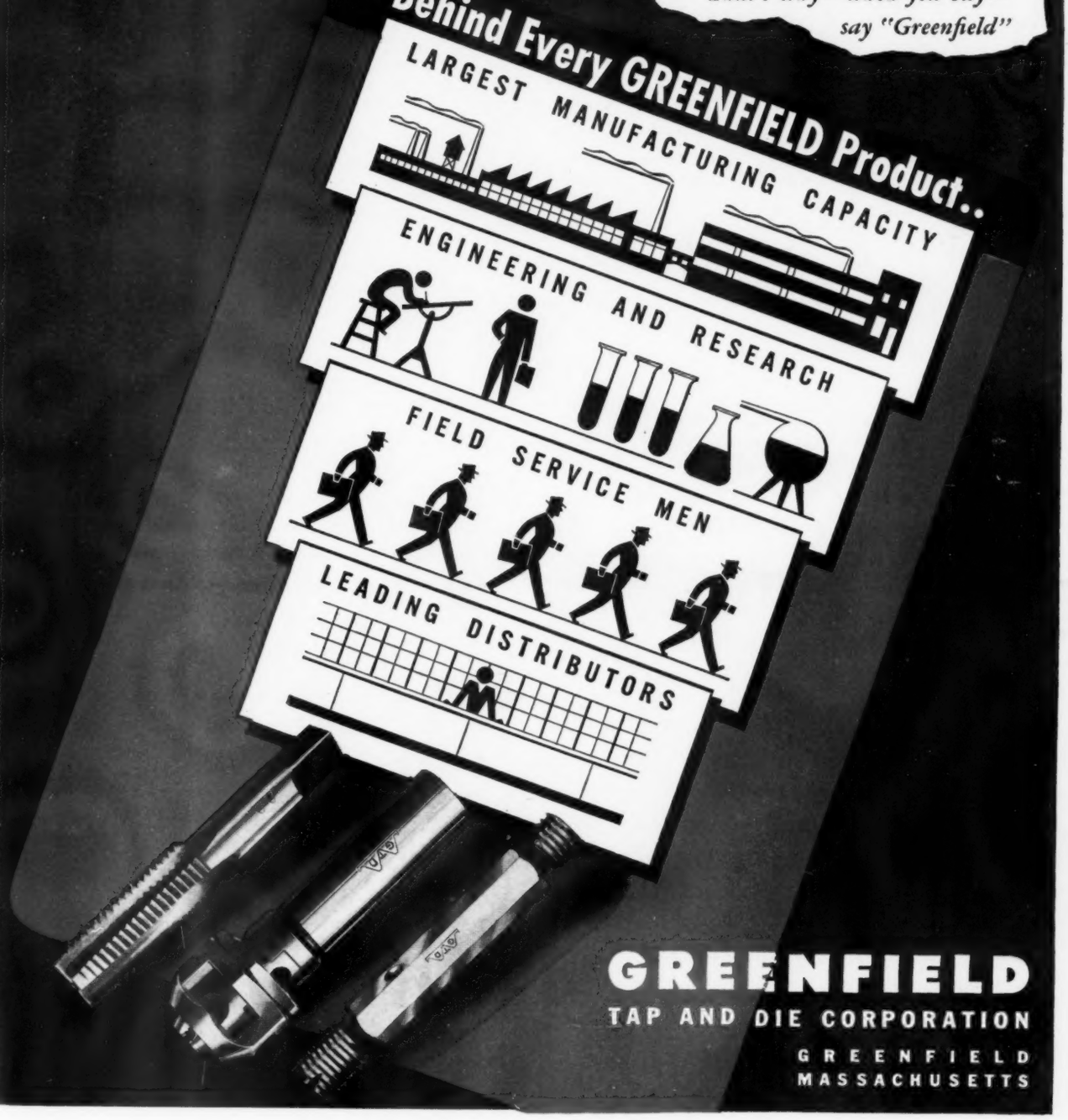
GTD

TAPS · DIES · GAGES

At first glance, all taps may look alike. It's what's *behind* the tap that tells its true value. When you buy "Greenfield"—you get these *plus values:* service from the country's leading distributors, "show-how" help from "The Greenfield Man" on your threading problems, benefit of the world's largest research staff of threading engineers, and the quality of product that comes from the largest, most modern threading tool plant in the world.

That's why—when you buy—
say "Greenfield"

Behind Every GREENFIELD Product..



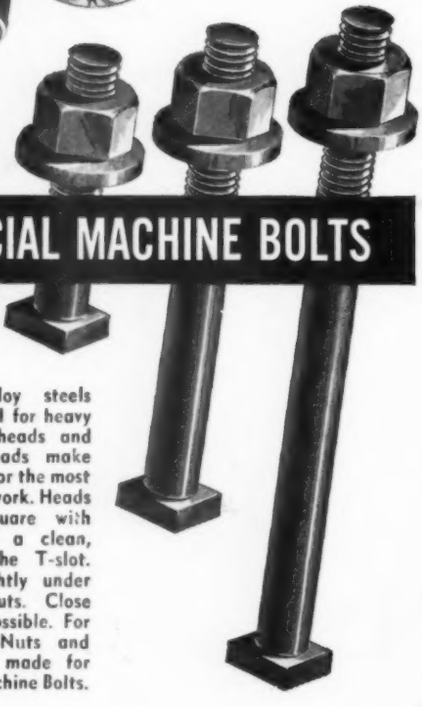
GREENFIELD
TAP AND DIE CORPORATION
GREENFIELD
MASSACHUSETTS

BOYAR-SCHULTZ

COPPER HEAD LAPS

. . . Pay for themselves in time saved. They work fast; they never wear out. The only wearing part is the replaceable sleeve. Sleeve adjustment feature permits maintaining correct lapping size till worn out and replaced with a new sleeve. Costly tool room time is saved by using Boyar-Schultz Copper Head Laps. Available from stock in standard sizes $\frac{1}{8}$" to $2\frac{1}{2}$".

SPECIAL MACHINE BOLTS



Heat treated alloy steels make them TOUGH for heavy work. Machined heads and carefully cut threads make them ACCURATE for the most exacting tool room work. Heads are machined square with bodies, presenting a clean, flat surface to the T-slot. Work is held tightly under heavy machine cuts. Close adjustments are possible. For best results use Nuts and Washers specially made for use with Special Machine Bolts.

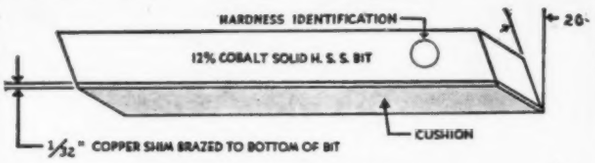
BOYAR-SCHULTZ
CORPORATION

2109 WALNUT STREET **CHICAGO 12, ILL.**

Now-for the first time-a real

GENERAL PURPOSE

tool using the **HIGHEST COBALT HIGH SPEED** *Steel*



65-68 Rockwell "C" Hard

PRICE LIST
Cushioned Solid 12% Cobalt H.S.S. Tool Bits

Size of Bit			In Lots of		
			1-9	10-49	50+
3/16	3/16	2 1/2	$ .60	$ .55	$ .50
5/32	5/32	2 1/2	.80	.75	.70
3/16	3/16	3	1.05	1.00	.95
7/32	7/32	3 1/2	1.45	1.40	1.35
1/4	1/4	4	2.00	1.95	1.90
5/16	5/16	4 1/2	3.10	3.05	3.00
3/8	3/8	5	4.60	4.50	4.40
7/16	7/16	6	7.20	7.10	7.00
1	1	7	10.20	10.10	10.00

The "cushion" does it—you get the extreme Rockwell and RED HARDNESS of 12% Cobalt H.S.S., plus an EFFECTIVE TOUGHNESS heretofore unobtainable with High Speed Steel Tools.

Gives production increases of from 20% to 200% through increases in speed and feed.

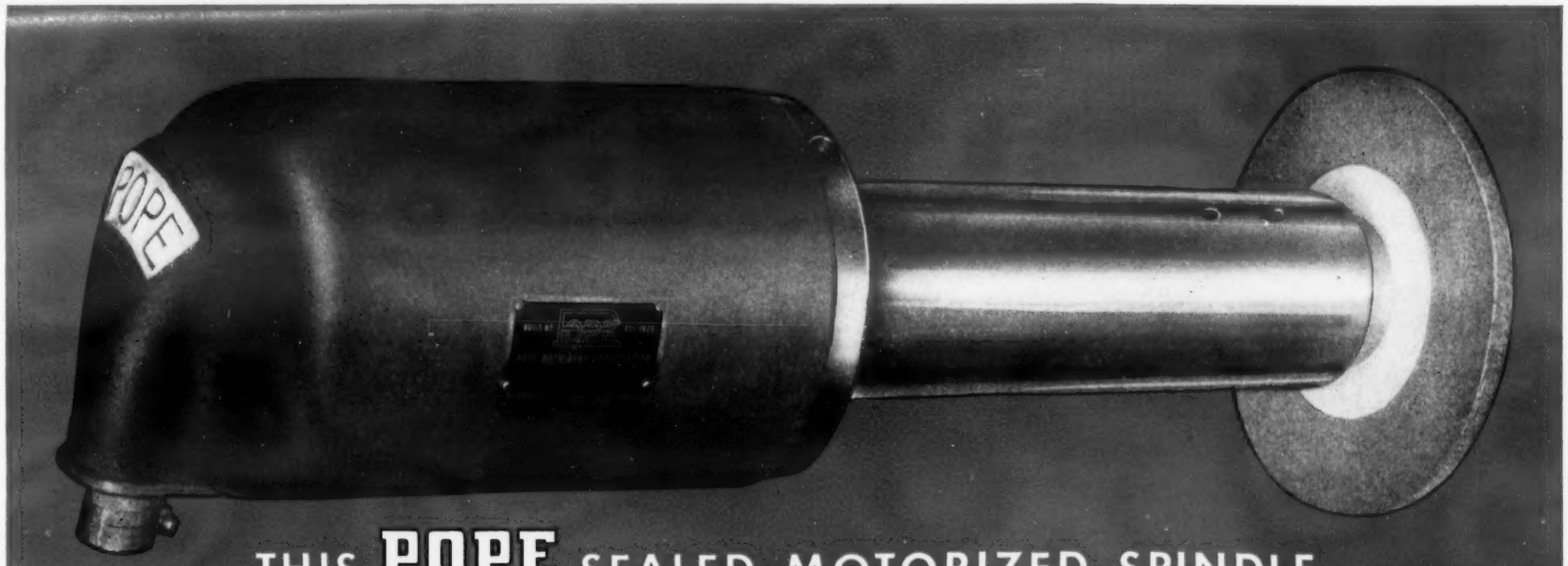
● IDEAL FOR SHAPER AND PLANER WORK AND INTERRUPTED CUTS. In many cases, these tools will remove more metal per minute than cast alloy or carbides. The CUSHIONED BIT operates with greater feeds than can be used with the mentioned tools. The increase in feed often more than makes up for any sacrifice in speed since METAL REMOVAL is a function of feed AND speed.

We know this is difficult to believe, but a trial will convince you—and you are the one to be satisfied.

Guarantee: If not satisfied that this is the BEST GENERAL H.S.S. TOOL you have ever used . . . bits can be returned for FULL CREDIT.

Write for complete circular.
See these tools on display at the
National Metal Exposition Booth No. C-706

GENERAL TOOL & DIE CO., INC.
555 Prospect St., East Orange, N. J.
Phone ORANGE 5-2500



THIS POPE SEALED MOTORIZED SPINDLE BELONGS ON *Your* 6" x 18" SURFACE GRINDERS

Its full 1 HP G-E motor is sealed-in. It runs at top efficiency, without attention. Dust, dirt, nuts, bolts and fingers are sealed out. Its extra large SKF Super-Precision, Double Row roller bearings and the thrust bearings are sealed in, too. No lubrication to worry about.

These exclusive features, combined with Pope precision craftsmanship, result in a spindle that will rough off surplus metal fast and then produce a superior finish.

Every 6" x 18" surface grinder needs to be equipped with this Pope Sealed-in Motor, Sealed-in Lubrication Unit

FOR FINER FINISHES AND PEAK PRODUCTION

Order one of these spindles and see for yourself.

Send us the name of your 6" x 18" Surface grinders and we will be glad to send you quotations.

No. 30

POPE

POPE MACHINERY CORPORATION
ESTABLISHED 1920
261 RIVER STREET • HAVERHILL, MASSACHUSETTS
BUILDERS OF PRECISION SPINDLES

POPE

You Save The COST!

of a STOW

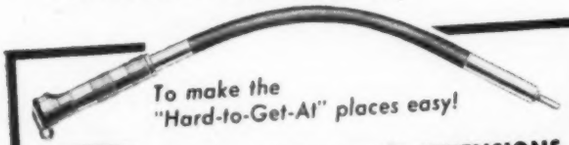
MOBILE POWER UNIT

When you roll it right up to the job . . . in any part of the shop . . . for any of these operations:

DRILLING · GRINDING · POLISHING

FILING · SANDING · BUFFING

● *On sale in principal manufacturing centers.* A POSTCARD WILL BRING YOU LITERATURE AND DISTRIBUTOR'S NAME. Write today.



To make the "Hard-to-Get-At" places easy!

STOW FLEXIBLE SHAFT DRILL EXTENSIONS

For the tough, awkward positions, this STOW Unit can be chucked in any standard electric or pneumatic drill. Drilling is more accurate, less tiring . . . *more economical* and safer for workman and the work.

3 heads for 3 kinds of jobs!

90° **collet-type head**—drills within ½" of angle corners with accuracy. Direct-geared spindle.

90° **angle-head**—Off-set spindle and patented chuck allows "tight-spot" drilling within ¼" of angle corners, etc.

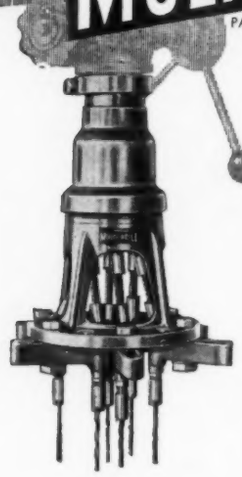
45° **angle-head**—STOW-designed for especially close drilling with any size drill up to No. 30.

STOW MANUFACTURING CO.

29 Shear St. Binghamton, N. Y.

MULTI-DRILL ADJUSTABLE

PATS. PENDING



Drill 6 Holes at One Stroke— Adjustable for *any* Pattern!

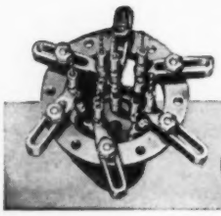
Your drill presses equipped with adjustable MULTI-DRILL heads will

- Reduce costs thru multiplying your present drill press production
- Conserve valuable floor space in your shop or departments
- Reduce your equipment investment
- Often save their cost on the first job

The MULTI-DRILL attaches conveniently to most ½" drill presses. Its six radially adjustable spindles are quickly set to any hole pattern within 5" circle—11/16" minimum centers. Standard capacity 3/32" to 17/64" drills. Many modifications are available for your special applications at slight additional cost.

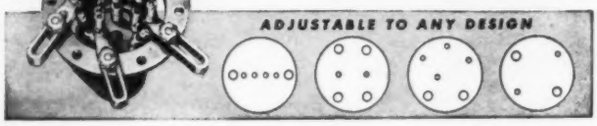
Write today for circular.

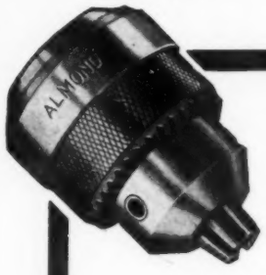
Any Hole Pattern

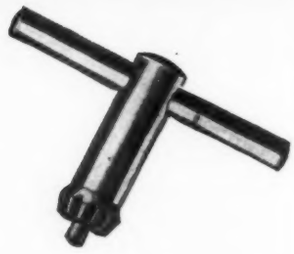


COMMANDER MFG. CO.

4229 Kinzie St., Chicago, U.S.A.







Almond Drill Chuck

THE FIRST IN THE FIELD

ALMOND THREE-JAW DRILL CHUCKS were the first to be placed on the market over Seventy years ago. As Pioneers in the field of Drill Chucks, the name "ALMOND" has long been associated with the logical procedure of machine developments. ALMOND DRILL CHUCKS are made in types and sizes to fit all machine tools and portable drills.

Complete information is available on request.

The Original Manufacturers of Drill Chucks

T. R. ALMOND MFG. CO.

Ashburnham, Mass., U.S.A.

PEAK PERFORMANCE
• There's a CLEVELAND Reamer for every job. And every reamer that carries the C trade-mark can be counted upon to finish the maximum number of holes at minimum cost. For peak performance, always specify CLEVELAND Twist Drills, Reamers, Screw Extractors, Arbors, Mandrels, Sockets, Mills and Counterbores.
Telephone YOUR I INDUSTRIAL S SUPPLY D DISTRIBUTOR FIRST!
The CLEVELAND TWIST DRILL COMPANY
1242 EAST 49th STREET
CLEVELAND
TRADE MARK REG. U. S. PAT. OFF. AND FOREIGN COUNTRIES
70 THOMAS ST. NEW YORK
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"CLEVELAND" DISTRIBUTORS EVERYWHERE ARE READY TO SERVE YOU

Gear Puzzle with a Payoff for your Plant!

Call in SOCONY-VACUUM for this Correct Lubrication Program

- Lubrication Study of Your Entire Plant
- Recommendations to Improve Lubrication
- Lubrication Schedules and Controls
- Skilled Engineering Counsel
- Progress Reports of Benefits Obtained

GARGOYLE Lubricants

NO, this isn't an engineer's nightmare! It's our conception of the different types of gears in your plant, linked in a continuous train. Production costs . . . and profits . . . depend on efficient operation of gears like these. Each gear has its own lubrication needs.

Some are ordinary open gears. Socony-Vacuum makes a special "Black Magic" fluid to prolong their life. There's a worm gear. Socony-Vacuum has special oils that stay on despite the wiping, sliding action. There are herringbone gears, hypoids, bevels and spiral-bevels. Socony-Vacuum engineers have the products . . . and the knowledge . . . to assure scientific lubrication for every type under every condition.

The same applies to all bearings and cylinders. Socony-Vacuum's great new wartime developments, backed by 80 years' lubrication experience, are available in a Complete Lubrication Program for your plant. Insure maximum machine efficiency now with this program.

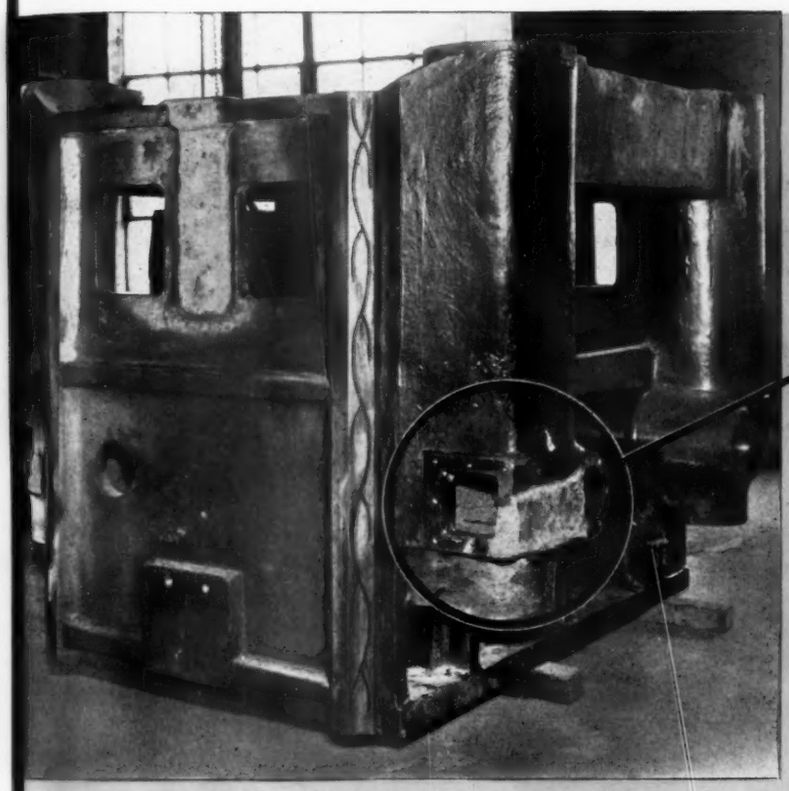
Socony-Vacuum Oil Co., Inc.

and Affiliates: Magnolia Petroleum Company, General Petroleum Corp. of Calif.

Tune In "Information Please"—Monday Evenings, 9:30 E.S.T.—NBC

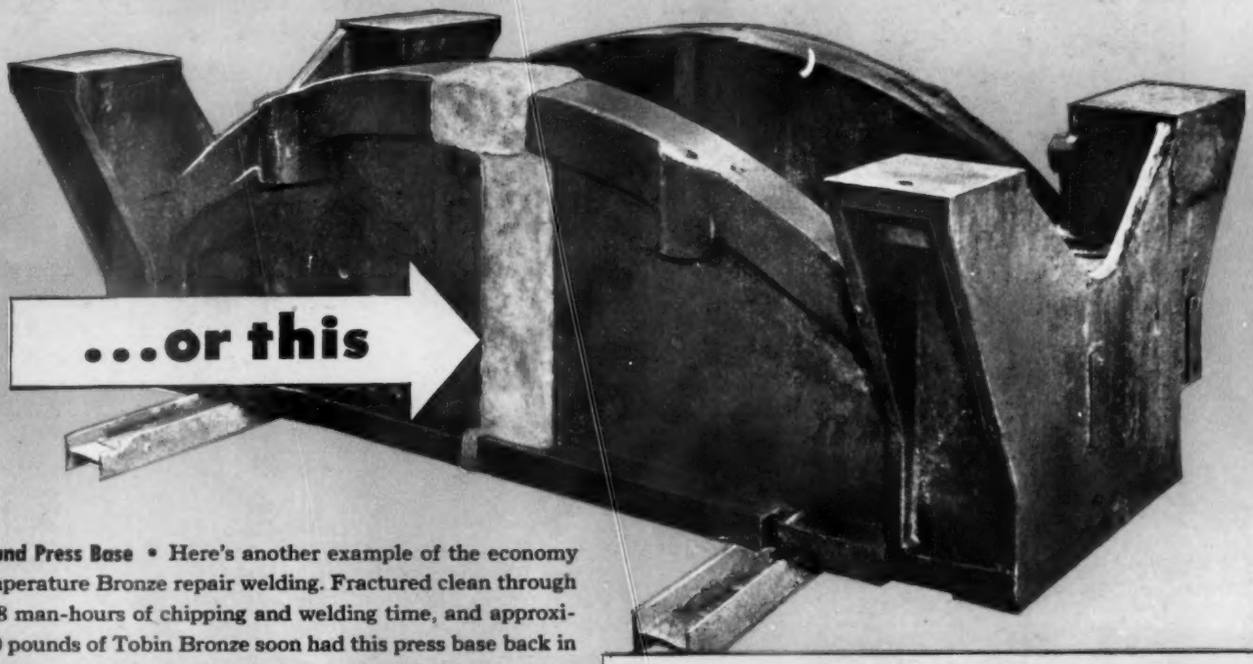
BRONZE WELDING-
First Aid for repairs

...on big jobs like this



18,500-pound Hydraulic Press Casting • 350 pounds of Tobin* Bronze saved this expensive piece of automobile production equipment from the scrap pile. Two hydraulic cylinders were repaired as illustrated at the left, and in the close-up above. The casting was received on a Friday, repair-welded over the week-end, and delivered to the customer on Monday morning ready for machining. The Bronze weld in the frame had been made several years ago and has stood up under heavy production ever since.

...or this



10,250-pound Press Base • Here's another example of the economy of low-temperature Bronze repair welding. Fractured clean through the web, 68 man-hours of chipping and welding time, and approximately 300 pounds of Tobin Bronze soon had this press base back in production on automobile bodies. Both this job and the one above were repaired by the Super Arc Welding Company of Detroit. Other illustrations of Bronze welding appear on the following page.

*Reg. U.S. Pat. Off.

or little jobs like this...

DON'T SCRAP IT... BRONZE WELD IT!

The illustrations above and on the previous page are typical of the equipment on which economical, permanent repairs can be made with Tobin* Bronze, "997" (Low Fuming) and other Anaconda Bronze Welding Rods.

For years this method of low-temperature repair welding has been used by many shops for reclaiming broken, fractured or worn equipment, or for building up bearing surfaces. Almost any part made of cast iron, steel, malleable iron or copper alloys can be Bronze welded quickly, dependably, and at a fraction of the cost of new replacement parts.

If you have war-worn machinery, machine tools or mechanical equipment to put back in shape, and your shop is not equipped to do its own Bronze repair welding, check with your directory or the nearest Office or Agency of The American Brass Company. There are dependable Bronze welding repair shops in most industrial areas.

Publication B-13 will tell you more about Anaconda Welding Rods for oxy-acetylene repair and construction work, and electric welding of copper and copper base alloys. A copy of this booklet will be sent on request. 46153

THE AMERICAN BRASS COMPANY

General Offices: Waterbury 88, Connecticut • Subsidiary of Anaconda Copper Mining Company

In Canada: ANACONDA AMERICAN BRASS LTD., *New Toronto, Ont.*

Quick Repairs to Propellers • Damaged bronze propellers that come into ship-repair shops must be put back in service with minimum loss of time. Here, at the Sullivan Dry Dock and Repair Corporation in Brooklyn, they are speedily and thoroughly reconditioned . . . with tough, sound welds of Tobin Bronze. Worn and slightly damaged edges are built up with weld metal. When a large section of a blade is broken or damaged beyond reclaiming, it is sawed off, and a piece of wrought bronze plate or a segment cast to shape is then welded into place.

*Reg. U.S. Pat. Off.

ANACONDA
from mine to consumer

Anaconda Bronze Welding Rods

Specify MO-MAX for
SUPERIOR PERFORMANCE
YOU CAN expect better results from tools made of this pioneer molybdenum-tungsten high speed steel. MO-MAX has clearly demonstrated its superior qualities in drills, reamers, lathe tools, cut-off tools, tool bits, milling cutters, hobs, circular saws, thread rolling dies, counterbores, broaches, lathe centers, spot facers, circular and flat forming tools, dies for both hot and cold work, taps, thread chasers, etc.
MO-MAX

MOLYBDENUM-TUNGSTEN HIGH SPEED STEEL

is available from the mills listed below. Each brand name represents a steel that is made according to a genuine MO-MAX formula.

ALLEGHENY LUDLUM STEEL CORP. . . "LMW"
ATLAS STEELS, LIMITED . . . . . "MOHICAN"
BETHLEHEM STEEL COMPANY . . . . . "BETHLEHEM HM"
BRAEBURN ALLOY STEEL CORPORATION . "MO-CUT"
CARPENTER STEEL COMPANY . . . . . "STAR MAX"
COLUMBIA TOOL STEEL COMPANY . . "MOLITE M-1"
CRUCIBLE STEEL CO. OF AMERICA . . "REX T-MO"
HENRY DISSTON & SONS, INC. . . . . "DI-MOL"
FIRTH-STERLING STEEL COMPANY . . . "HI-MO"
HALCOMB STEEL COMPANY . . . . . "REX T-MO"
JESSOP STEEL COMPANY . . . . . "MOGUL"
LATROBE ELECTRIC STEEL COMPANY . . . . "TATMO"
ST. LAWRENCE ALLOYS, INC. . . . . .
SIMONDS SAW & STEEL COMPANY . . . . . "S.T.M."
UNIVERSAL-CYCLOPS STEEL CORP. . . . . "MO-TUNG"
VANADIUM-ALLOYS STEEL COMPANY . . . "8-N-2"
VULCAN CRUCIBLE STEEL COMPANY . . . . "VUL-MO"

FOR THE FULL STORY ON MO-MAX high speed steels—their physical properties, their advantages, and how to heat treat them—write today for the new, revised MO-MAX Handbook.

★ ★ ★

THE CLEVELAND TWIST DRILL COMPANY • 1242 East 49th Street • Cleveland 14, Ohio

NOW!

YOU CAN GET THE "CHANDLER-DUPLEX"

COMBINED BORING AND FACING TOOL HEAD IN SEVERAL SIZES

INTRODUCING THE NEW HEAVY DUTY MODELS

POWER FEED FOR FACING!

DO ALL OPERATIONS IN ONE SET UP FOR JIG BORER, MILLING MCH., DRILL PRESS, ETC.

"A BORING HEAD THAT WON'T FACE ISN'T COMPLETE"

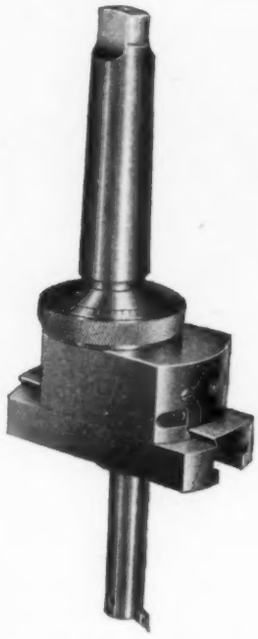
ONE SIZE

MODEL D
Slide Travel 1 in.
Boring Capacity 0 to 8 in.

The power feed feature for facing operations insures smooth, uniform movement of tool across work surface. This power feed can be engaged or disengaged instantly. Adjustment of tool for boring is obtained in increments of one tenth in direct reading.

Cutting bar may be set to any position in Tee Slot of Slide. Hardened and ground throughout. Feed screw and worm gear ground from solid. Bronze feed nut and bushings. All type shanks interchangeable. *Write for full details.*

MANY NEW IMPROVEMENTS ADDED



MODEL H.D.
Slide Travel 2½ to 4½ in.
Boring Capacity 0 to 26 in.

CHANDLER TOOL CO.
MUNCIE, INDIANA

514 OHIO AVE. **PHONE 4973**

ENGINEERS-PRODUCTION-INSPECTION MEN!

BOOST PRODUCTION AND PRODUCT QUALITY — 15 DAY SHIPMENT OF URGENT ORDERS

Curtiss-Wright Corporation ranks our product with their best tools. Cleveland Graphite Bronze Company, Leading Bearing Manufacturer, States New High Accuracy Reached, Plus Substantial Production Boosts.

No More "C" Washers, Wrenches, Drawbars; No More Arcs or Tapers Before or After Expansion Grip—Concentricity in Low 10,000ths—Production or Inspection.

Assured parallelism of sleeve surface to center line—absolutely no variation in repeated mounting of parts.
Uniform full-work-length friction-locking gives complete control and contact of entire bore surface area—absolutely no variation in repeated mounting of parts—no tapers—Slip part on mandrel with slight counter-clockwise motion, that's all—it's ready—Self-contained, self-expansion, self-locking, self-contraction. Instant unloading, no jamming, no adjusting — Interchangeable sleeves—you do not obsolete Young Mandrels. Built to your bore tolerance high limit, with automatic contraction to low limit—Any mounting—Any machine operation—For bore diameters .718 to 5.5—Reduces tool costs, extra equipment investment, operating costs, maintenance, down time, scrap, salvage.

Patent Pending

Quotations Definitely Moderate
Good Delivery Schedules

Young Roller Clutch Precision Mandrels

YOUNG ARBOR CO. 3257 BRADFORD ROAD CLEVELAND HTS. 18, O.

STANDARD US HEADS SINCE 1915

All Types of Fixed Center

DRILLING TAPPING & BORING HEADS

Four Spindle Head. All Spindles Adjustable for equally spaced holes.

FIVE TYPES, 56 SIZES, ADJUSTABLE DRILL HEADS

UNITED STATES DRILL HEAD CO., CINCINNATI 4, OHIO

Hardness Testing Problems Always Suggest

"ROCKWELL" HARDNESS TESTER

(or for micrometric tests the "TUKON" Tester)

made only by

WILSON

MECHANICAL INSTRUMENT CO. INC.
357 Concord Ave., New York 54

An Associate Company of American Chain & Cable

JESSOP warehouses are strategically located to expedite delivery of JESSOP TOOL STEELS and other JESSOP Specialty Steels. Since the end of the war our mill and warehouse stocks have steadily increased, so that in most cases the steel you order will be on its way within a matter of hours.

Through the JESSOP WAREHOUSE SERVICE you can make substantial reductions in your tool steel inventories, because adequate stocks are available *when* you need them. And by lowering your inventories you will have more capital available for your reconversion program.

JESSOP High Speed, Alloy and Carbon Tool Steels are stocked in all standard shapes and sizes. The Jessop technical service representative will assist you in selecting the tool steel best fitted for your needs. And the Jessop Warehouse Service will insure your receiving the steel *when* you need it. Phone or write the nearest Jessop branch office for immediate help on your tool steel problems.

JESSOP STEELS CARRIED IN STOCK:

TOOL STEEL (high speed, alloy, and carbon) in bars, forgings, and sheets; HOBBING STEEL; CAST RING DIE; DRILL ROD (carbon, oil hardening, high speed); MUSIC WIRE, any size coil; CUTTING TOOLS, high speed tool bits in all grades (sand blasted or ground), cast non-ferrous bits, carbide tipped tools; GROUND GAGE STOCKS, water and oil hardening; OIL HARDENING GROUND PLATE; STAINLESS STEEL in bars (hot rolled and cold finished), sheets, and plates; STAINLESS WELDING ROD.

JESSOP STEEL CO.

WASHINGTON, PENNA.

THE HARTFORD SUPER-SPACER

Hartford Super-Spacer equipped with face plate for precise work location on jig borer.

Explore the possibilities of this device as a time-saver on indexing work.

The HARTFORD SUPER-SPACER has contributed much to faster set-ups and furnished rigid control on a wide range of jobs. To investigate its possibilities on your work is to open the way to worthwhile savings in time and effort where indexing is involved.

The typical job shown here is representative of the versatility of this tried and proved, modern indexing device. Its wide use on drilling, milling, grinding and other operations is indicative of its universal acceptance in shops where minutes count and costs are carefully scrutinized.

Ask our engineers to cooperate with you in finding the answer to your indexing problem. Write for further details of the HARTFORD SUPER-SPACER and its many applications.

THE
HARTFORD SPECIAL MACHINERY CO.
HARTFORD 5,
CONN.

It's a NEW WALKER

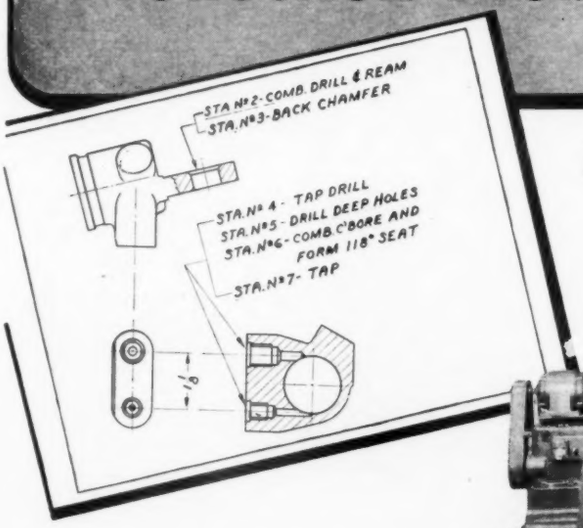
LONGITUDINAL *BAR POLE* MAGNETIC CHUCK

This new Walker Chuck is now aailable in standard and special sizes for early delivery. The unit illustrated is a standard 10" x 80" chuck of this improved design.
Walker . . . always a leader in the specialized field of Magnetic Chucks . . . continues to maintain its position by keeping pace with current requirements and by anticipating future needs. Improvements in design go hand in hand with new developments of Walker equipment. That is why Walker is "out in front" in its field and why Walker Magnetic Chucks are so universally accepted as standard by the metal working industry.

If you have a chucking problem, come to Walker for assistance.

O. S. WALKER COMPANY, INC.
★ WORCESTER • MASS. ★
Makers of Rectangular, Swivel and Rotary Magnetic Chucks

How a Complex Production Problem was Simplified


STA. No 2 - COMB. DRILL & REAM
STA. No 3 - BACK CHAMFER
STA. No 4 - TAP DRILL
STA. No 5 - DRILL DEEP HOLES
STA. No 6 - COMB. C'BORE AND FORM 118° SEAT
STA. No 7 - TAP
1/8

AGAIN DEMONSTRATING THE VERSATILITY OF STANDARD LE MAIRE UNITS

Wheel cylinder shown in diagram produced at rate of 14 A MINUTE

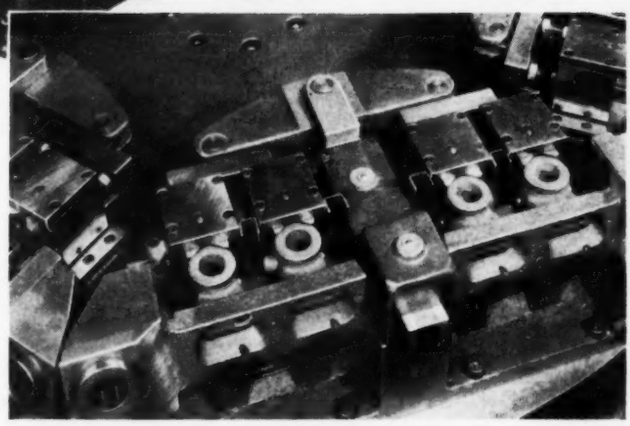
DRILLING, REAMING, BORING, COUNTERBORING, CHAMFERING, TAPPING *all at one setting*

Here's a machine that gives you maximum production with minimum handling. Since all the operations are performed without removing parts from the fixture, great accuracy is assured.

Here's a special purpose machine, completely designed and built by LeMaire, utilizing standard LeMaire Units as a basis of the operating factors: five No. 2000 self-contained hydraulic drilling units and one No. 150 lead screw tapping unit.

All units are mounted on a fabricated base, housing a 7-station, 54" diameter automatic index table.

The fixture, which holds 4 parts to a station, is clamped by air cylinder and released by cam rail. Brackets mounted on each end of fixture contain 2 bushings which nest pins on bushing plates of drill units and head of tapping unit to assure positive alignment.



Where increased production is sought under most efficient methods, give consideration to this simple and economical way of having us design and build special purpose machines through application of these standard LeMaire Hydraulic Power Units.

The operation subsequent to the one described here will be shown next month.

LeMaire

LE MAIRE TOOL & MANUFACTURING CO., 2657 SO. TELEGRAPH RD., DEARBORN, MICHIGAN

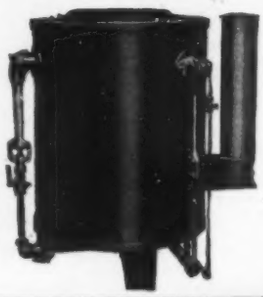
Designers and Builders of unit and way-type machines for single or multiple spindle drilling, boring, reaming, tapping, etc . . . Twin Ram Hydraulic Power Units . . . Match-it Gear Chucks

"BUZZER" HIGH SPEED *Gas* FURNACES

2400° F.
attained quickly with "BUZZER" High Speed Full Muffle Furnaces.

Designed primarily for high carbon and alloy steels.

NO BLOWER or POWER NECESSARY ... just connect to gas supply



"BUZZER" Atmospheric Pot Hardening Furnaces assure even heat up to 1650° F.

Used for Salt, Cyanide and Lead Hardening. Also adapted for Melting Aluminum.

Send for the complete "BUZZER" catalog today.

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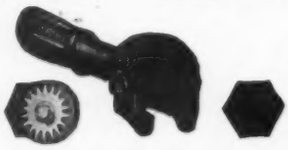

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We manufacture a complete line of Dressers and Cutters. Write for copy of catalog "A".

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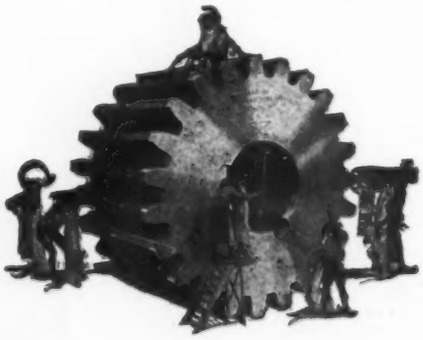

Better Gear Products

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CUT ALL GEARS TYPES

MEMBER OF AGMA

GANSCHOW GEAR CO., 14 N. Morgan Street, CHICAGO 7.

Minimum Maintenance IS BUILT* INTO SCHNEIBLE DUST CONTROL EQUIPMENT

CLEAN AIR OUTLET
ENTRAINMENT SEPARATOR
WATER INLET
IMPINGEMENT PLATES
*No moving parts in collector. Nothing to wear, break or clog.
*Internal parts protected against abrasive wear by water bath
DIRTY AIR INLET
WET CYCLONE FOR COLLECTING HEAVY MATERIAL
WATER AND SLUDGE OUTLET

The first cost of Schneible Multi-Wash Collectors — although comparable with that of less efficient equipment — is practically the only cost. Every Schneible unit is correctly designed and built for long, trouble-free service.

The tower of a Schneible collector, pictured above, is ruggedly constructed of steel plate — or other material for special requirements. No matter how erosive the material collected may be, all interior surfaces are adequately protected against abrasion by sheets of flowing water, which act as a cushion. There is no appreciable contact between the abrasive material collected and the parts.

There are no moving parts in the air stream — no parts in the Schneible collector which break, burn, clog or rapidly wear.

Consequently, Schneible dust control equipment requires *a very minimum of maintenance.*

In operating cost a Schneible system is likewise lowest. It will function indefinitely with practically no attendance. There are no filters, screens or bags to require periodical cleaning. The collected matter, as sludge, is disposed of far more easily than dust.

One of the prime reasons why so many plants are installing Schneible Multi-Wash dust and fume collection systems is that they are the most economical in the long run.

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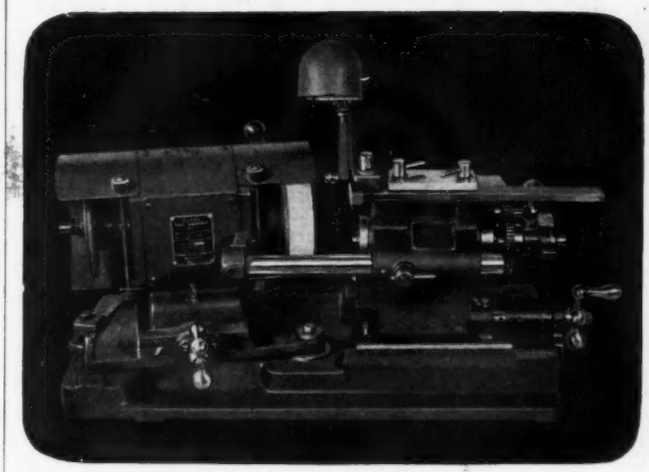

The easiest way to get More Holes per $ $ $ . . . the BLAKE TAP GRINDER

EVERY OPERATION for the *accurate* and *quick* sharpening of taps is *easily* performed on the Blake Tap Grinder . . . because we've spared no effort in making it so.

- *Each* adjustment is simple and *easy to make.*
- It's *easy* to change from size to size, from right- to left-hand taps, to various lengths, various angles, and various amounts of relief—*with speed and precision.*
- Taps may be inserted and removed in a *few seconds.*
- *Positive* mechanical controls make *accurate* sharpening of taps an almost automatic operation.
- A *simple* locating device insures *correct* positioning and duplication of work.

This special attention to ease of operation allows you to use semi-skilled labor to take care of your tap sharpening. In fact, excellent results are obtained from green help after only a few hours of instruction.

Complete details of the Blake Method are yours for the asking—the coupon makes it easy.

Please send me Bulletin 544 which gives complete details on Blake Tap Grinders.

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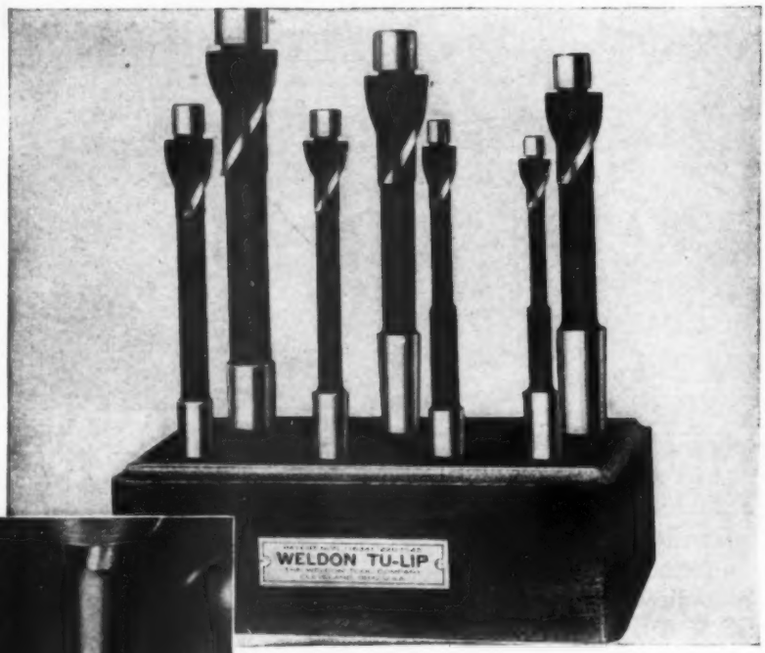
BLAKE TAP GRINDERS—FILTAIRE PORTABLE DUST COLLECTORS—AMERICAN TOOL HOLDERS—BLACK DIAMOND PRECISION DRILL GRINDERS—WALTHAM CUTTER SHARPENERS—HAGER CARBIDE TOOL GRINDERS

YESTERDAY'S PIONEER • • • TODAY'S LEADER

WELDON "TU-LIP" COUNTERBORE *for* FAST FREE CUTTING



As the name implies, the WELDON "Tu-Lip" Counterbore has only two cutting lips or flutes. This feature, together with the fast spiral, makes the "Tu-Lip" the fastest, freest cutting counterbore on the market.

Tool room service also is greatly reduced because there are only two cutting lips to grind and it will cut much longer between sharpenings. Breakage due to clogging is prevented because this improved cutting tool provides more than ample chip room. Furnished singly in sizes desired or in convenient wood block sets as illustrated.

Write for sizes and prices.

THE WELDON TOOL CO. *Cleveland 4, Ohio*

3000 WOODHILL ROAD

IMMEDIATE DELIVERY

No. 1 to 60
New High Speed
Long Length

DRILLS

No. by Gage	*Length*	*Our Price Net Each*
1 to 10	6¼"	$.90
11 to 20	5¾"	.80
21 to 30	5⅜"	.70
31 to 40	5¼"	.60
41 to 50	4½"	.50
51 to 60	4¼"	.40

If you buy 24 or more—10% Discount
If you buy 60 or more—20% Discount
If you buy 100 or more—25% Discount

VICTOR MACHINERY EXCHANGE INC.
251 CENTER STREET
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PREVENT CONTAMINATION – EXTEND TOOL LIFE

with the NEW BARRETT COMBINATION STERILIZER AND SEDIMENTOR for CUTTING OILS . . . .

Barrett Sterilizer and Sediment Precipitator arranged for fully automatic operation.

Protects your operators against infection—insures more and better work from your cutting tools—by sterilizing your cutting oils and precipitating sediment *at the same time.*

The NEW BARRETT STERILIZER AND PRECIPITATOR combines these two operations in one piece of apparatus which can be depended on to handle both operations effectively, efficiently and economically. Sterilization is by heat and is a positive active operation in the line ahead of the supply tank. By locating in this position, contamination is intercepted before the cutting oil is conditioned for safe, bacteria-free reuse.

Because of the heat to which the oil is subjected during sterilization, the viscosity of the cutting oil is reduced, thereby encouraging precipitation of minute heavy particles. The sediment thus liberated settles out and drops by gravity to the bottom of the sterilizer where provision is made to scrape the precipitated solids from the conical bottom and clean them out.

By thoroughly and constantly sterilizing and effectively removing solid matter, the Barrett Combination Sterilizer and Sedimentor reconditions cutting oil for reuse; sterilized for safety's sake and abrasive-free for longer tool life.

GET COMPLETE INFORMATION NOW

These units are available for floor, wall and post mounting and are furnished with semi-automatic or full automatic control as required. Send at once for detailed information on this timely Barrett development.

THE LEON J. BARRETT CO., WORCESTER, MASS.

Designers and Builders of Centrifugal Machinery

ERRINGTON MECHANICAL LABORATORY

TAPPING CHUCKS

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170 Broadway

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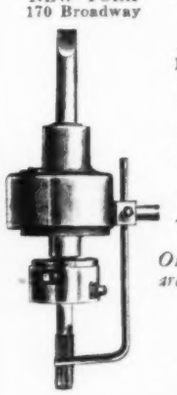
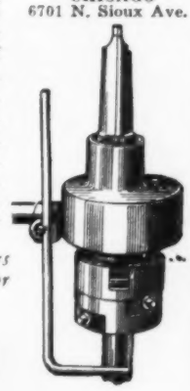
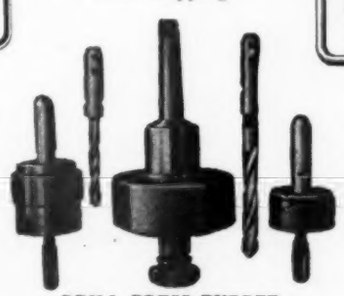
6701 N. Sioux Ave.

Size	Taps Exact Size
No. 00 H.S.	Up to 1/4"
" 00	1/8" 1/16"
" 0	3/16" 1/32"
" 1	5/16" 3/4"
" 2	7/8" 1 "
" 3	5/8" 1 1/4"
" 4	3/4" 1 1/2"
" 5	3/4" 2 "





Our High Speed Tappers are Super-Sensitive for Small Tapping



Style B Positive Stop Holds Work Down

Style C Graduated Adjustable Safety Friction

DRILL PRESS TURRET

Style D-E with Quick-Change Tool Holders to Drill, Tap and Set studs, etc., without moving work, or stopping or reversing machine. Individual friction adjustment in each tap-holder. If required.

Also, Opening Die-Heads; Opening Stud-Setters; Friction Screw-Drivers and Nut-Setters, etc.

NATIONAL KEYSEATING MILLER

. . . the tool that converts drilling machines into key-seaters and saves time and money

• With this modern tool you can handle keyseating jobs not suitable for keyseating machines on any of your drill presses or radials. Keyseats with parallel sides, accurate in depth and in perfect alignment with bore axis are assured.

The National Keyseating Miller mills, keyseats in one cut. It can be used on taper holes, offset holes, blind holes and for taper keys. Work clamping is unnecessary. We also manufacture oil-grooving millers.

Made in twenty-six different diameters from 1/2" to 3 1/2". Several widths of cutters can be used in each size.

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MASTER MACHINISTS

and leads to bigger pay!

This big home-study and reference course gives you the practical facts on machines and methods you need to advance in machine shop work. Take advantage of the other man's experience as found in books, to solve your problems, increase your efficiency with

AMERICAN MACHINISTS' LIBRARY

6 volumes, 2516 pages, 2368 illustrations, many charts and tables

THESE books answer your questions on methods and machines—tell what you need to know about the operation of machines of all types and sizes for the whole range of metal cutting, forming, and finishing operations—show by text, diagram, and illustration the essential points of setting up work, adjusting machines, selecting feeds and speeds, determining pressures, handling materials, devising short-cuts, etc.

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—practical information on grinding machines and abrasive wheels, showing what they do, how to operate them, and how to make best use of them on various types of work

—training in the various operations performed in drilling and surfacing materials in the machine shop

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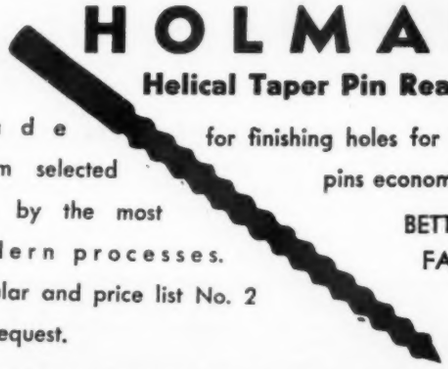
WORCESTER, MASSACHUSETTS

HOLMAN

Helical Taper Pin Reamer



Made from selected steel by the most modern processes. Circular and price list No. 2 on request.

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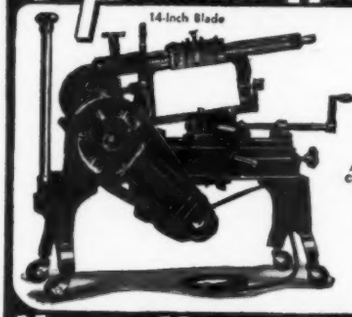

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SELF-CONTAINED
PORTABLE
STURDY
READY TO WORK
ECONOMICAL

Angle Cutting Vise

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NEW YORK 4, N.Y.

WRITE FOR BULLETIN NO. 400

MILLER-KNUTH MFG. CO. OMAHA, NEB.

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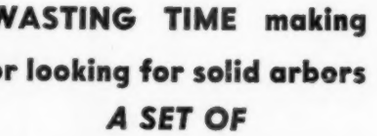
WASTING TIME making or looking for solid arbors

A SET OF

NICHOLSON EXPANDING MANDRELS

fits all bores 1" to 7"



Set of 19 of these economy, precision tools does the work of 193 solid arbors. Bulletin 1043.

W. H. NICHOLSON & CO., 114 Oregon St., Wilkes-Barre, Pa.

HOEFER MILLING HEADS

Counterbore

24 . . . 2½" DIA. HOLES IN 7.8 SECONDS . . . . .

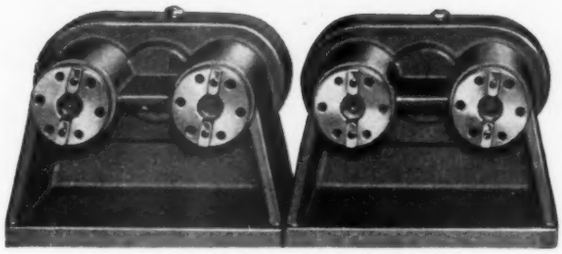
COUNTERBORING TRACK LINKS

2½ in. diameter by ⅜ in. deep holes. Speed 40 feet per minute — 61 r.p.m.

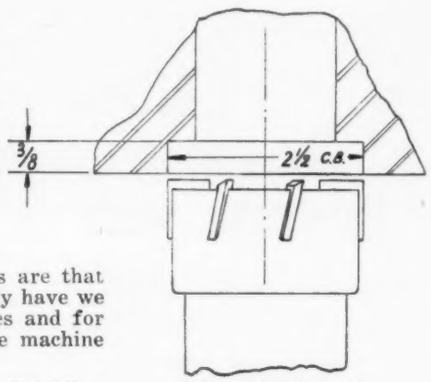
6 tooth cutter cuts .048 in. per revolution.

2.928 feet penetration per minute.

⅜ in. depth — 7.8 seconds actual machining time for both counterbores.



Two of a group of twelve two-spindle milling heads arranged for mounting of counterboring milling cutters with standard key drive for counterboring Track Links. The spindle construction is that of standard milling machine type.

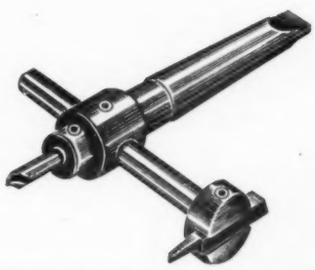


NO matter how difficult your problem may seem to you the chances are that we have furnished Multiple Spindle Heads for similar use. Not only have we built heads for mounting on drill presses but also on rotating spindles and for mounting on the turret of turret lathes motivating them through the machine spindle containing the work.

Hoefer Heads not only increase production per hour but decrease cost of drilling or allied operations . . . also they increase production from the same floor space (no new machinery needed) and decrease handling time.

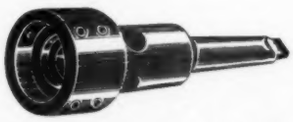
Write and tell us of your needs and we will make recommendations.

Hoefer's Whole Business is Holes . . . . **HOEFER MFG. CO.** *Freeport, Ill.*

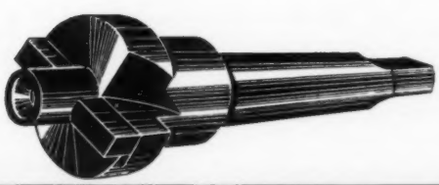


CIRCLE CUTTER. For 2" to 8" holes in sheets or plates of metal, plastic, fibre, wood, etc. 1¼" pilot. ¼" x ¼" bit. Straight or taper shank.

SPINDLE STOP. Expands by collet action in ¾" headstock spindle hole. Does not scar or burr. Extension can be turned down or removed.



DIE HOLDER. Accommodates 1" and 1½" button dies. Threads can be cut to ⅝" x 3". Chases threads straight and true. No. 2 MT shank.



MULTIFACER. For counterboring seats of many diameters and contours. Made in 4 stock sizes with straight or taper shanks. Standard bits can be ground to desired shapes.

YOU'LL BE PROUD TO OWN THESE *Tools*

There's quality through and through these tools—fine materials, fine construction, fine finish. They belong in high-class machine shops and factories for special jobs and production runs.

Think of the work in your shop right now and you'll see where one or all of these tools would save time and simplify operations. Think of past jobs on which the Multifacer or Circle Cutter or Spindle Stop or Die Holder would have paid for itself on a single run.

We have so much faith in these tools that we'll be glad to send you any of them on approval if you write on your firm's stationery to show your responsibility. If you want to know more about them first, mail the coupon for our fully descriptive literature and prices. Do this now while it's on your mind.

REPRESENTATIVES:

Z. W. Brouillard & Co., 43 Kenyon St., Springfield 9, Mass.; Harry E. Hummer, 115 Montclair Ave., Newark, N. J.; N. R. Fisher, 3478 W. 150th St., Cleveland 11; Elliott Machinery, 6 E. Buena Vista, Highland Park 3, Mich.; Tool Equipment Co., Indianapolis 4; Keene Elec. Mchy. Co., 549 W. Washington Blvd., Chicago 6; E. Sherman Hinds & Staff, 2488 W. Pico Blvd., Los Angeles 6 (N. W. States); Schellenbach Mach. & Tool Co., 480 Fifth St., San Francisco 7; Bridge Machinery Co., 768 St. Paul St., W., Montreal; Z. W. Brouillard & Co., Room 2111, 401 Broadway, N. Y. City, Export.

ALLEN TOOL & MFG. CO.
730 Steele Ave., Dayton 10, Ohio.

Send complete information on Multifacers, Circle Cutters, Die Holders, and Spindle Stops.

Individual

Company

Street Address

City, State

CONTRACT WORK

FREDERICK HART CO. INC.

SINCE 1895

A CONTRACT SHOP

FOR

50 YEARS

SPECIALIZING IN

PRECISION WORK

DESIGN & FABRICATION OF
SPECIAL MACHINERY
TOOLS — GAUGES
MODEL WORK

★

PRODUCTION & ASSEMBLY
OF
SMALL PRECISION PARTS
RADAR PLUMBING
AIRCRAFT HYDRAULICS

★

A MODERN SHOP
OVER 40,000 SQUARE FEET
EXPERIENCED CRAFTSMEN

Large enough to be complete and efficient; small enough to be personal.

OPEN CAPACITY NOW

FREDERICK HART CO. INC.

MANUFACTURERS OF
HARTRON and
RECORDGRAPH
SOUND RECORDING
EQUIPMENT

POUGHKEEPSIE, N. Y.
AN ATF ASSOCIATE

COMPLETE PLANT AVAILABLE FOR PRECISION WORK ON A CONTRACT BASIS

One story building—approximately 20,000 square feet—Separate storage building and office space. Present equipment consists of—Plain, Universal & Vertical MILLING MACHINES; BORING MILLS—Horizontal and Vertical; GRINDERS—Surface and Cylindrical; LATHES—12"—14"—16"—20" Engine; DRILLS—Sensitive and Back Geared; VERTICAL SLOTTERS; PROFILERS and Many MISCELLANEOUS MACHINES. Complete TOOL CRIB; ELECTRIC HOISTS; CLEVELAND TRAM RAILS and other WORK HANDLING DEVICES. 40,000 square feet of LAND, suitable for expansion.

GOOD LABOR MARKET —
TRAINED PERSONNEL
EXCELLENT LABOR RELATIONS

We invite correspondence from parties interested in having at their disposal a complete plant formerly employing approximately 200 skilled workers.

These Facilities Are Available Immediately

THE B. G. MACHINE COMPANY
610 FIRST AVENUE WEST HAVEN, CONN.

● Machines and Parts, ● Special Tools and Fixtures, ● Cam Milling, on Contract

Your engineering problems will receive efficient and economical service in our modern plant manned with skilled workers. Contact us today for prompt quotations on your blueprints or samples.

Designers and builders of wire and ribbon stock forming machines.

THE A. H. NILSON MACHINE COMPANY, BRIDGEPORT, CONN.

CONTRACT WORK

WANTED — WORK

ON CONTRACT BASIS TO YOUR SPECIFICATIONS

We offer a complete service for the Engineering, Development, and Manufacture of metal parts, assemblies, and machines.

Fully equipped, modern machine shop with complete production setup for all types of machine work.

Send blueprint or sample for prompt quotation without obligation.

SOUTH SHORE MACHINE & TOOL WORKS, INC.

Merrick Road Seaford, New York

WANTED TO MANUFACTURE

PRECISION MACHINE PARTS.
THREAD GRINDING & MILLING.
GRINDING:
Centerless, Cylindrical and Crankshaft;
TURRET AND ENGINE LATHE WORK;
MILLING AND DRILLING

Send us Sample or Drawing for Quotation

The STURTEVANT CO.

1023 E. 176th ST., NEW YORK 60, N. Y.

METAL STAMPINGS

• TOOLS • DIES •

PERMANENT MAGNETS

HEAT TREATING

THOMAS & SKINNER STEEL PRODUCTS CO.

1103 E. 23rd St. INDIANAPOLIS, IND.

FORM-GRINDING — is our business!

We are specialists in grinding and designing FORM counterbores, reamers, hollow mills, and related types of FORM flat-drills.

Send your "REQUEST FOR QUOTATION" today

J. & S. TOOL CO., 477 Main St., E. Orange 1, N. J.

(Makers of J. & S. Radil & Angle Dressing Tools)

GEAR CUTTING FACILITIES AVAILABLE

26 Gear Cutting and Hobbing Machines up to 24" capacity including Gear Shaving and Lapping Machines of Barber-Colman, Fellows, Gould & Eberhardt, and Gleason Bevel Type Machines available on account of present production not requiring gear mechanism. Prefer large quantities as capacity available for period of months.

REED-PRENTICE CORPORATION
Worcester, Mass.

PATTERNS in WOOD and METAL

For All Kinds of Castings, Large or Small
MATCH PLATE WORK A SPECIALTY
Put your pattern problems up to us — we will take care of them.

GENERAL PATTERN WORKS
2233 Buck Street Cincinnati, Ohio

PRECISION MACHINE WORK

ON CONTRACT BASIS EXACTLY TO YOUR SPECIFICATIONS.....

A complete and efficient service for the manufacture of machine parts, Special Tools, Fixtures, Etc., is available in our fully equipped modern shop.

Quality work guaranteed at reasonable cost. Send blue prints or samples for prompt quotation.

Robertson Tool Co., Inc.

424 Broadway, Malden, Mass.

STAMPINGS AND ASSEMBLIES

IN ALL KINDS OF METALS

Fast and efficient service on long or short runs is guaranteed by our modern equipment and methods, backed by 50 years of experience.

We also offer facilities for the manufacture of screw machine products, tools, dies, jigs and fixtures.

Quality work by skilled mechanics is assured. Send your blueprints or samples today.

"GREATER SAVINGS WITH GREIST"

THE GREIST MFG. CO.
546 BLAKE ST. NEW HAVEN, CONN.

WIRE AND METAL SPECIALISTS

In round, flat, square and special shaped wire in all metals.

LARGE PRODUCTION CAPACITY

Plating and finishing.

EASTERN TOOL & MFG. CO.
BLOOMFIELD, N. J.

BUILDERS OF SPECIAL MACHINERY TOOLS & DIES

THE SPECIALTY MACHINE TOOL & DIE CO.
923 Market St. (Rear) Wheeling, W. Va.

SEARCHLIGHT SECTION

CONTRACT WORK

(Continued from pages 224 & 225)

SPECIALTIES — PRECISION WORK

Available capacity for automatic screw machine products up to 1⅝" diameter.

Equipped for secondary operations: Thread rolling and chasing, centerless grinding, slotting, drilling, heat treating, and plating.

Forward blueprints for quotations. Prompt-efficient service.

JOHN L. BUXTON CO.

2540 Reed Street **Philadelphia 46, Pa.**

Tel.: FULton 0628 and 0629

REED MACHINE & TOOL ENGINEERS

MACHINE & TOOL DESIGN • CONSULTING • OPERATIONS

CONTRACT PRODUCTION MANUFACTURING

PHONE — PERRY 5930 ★ **PAWTUCKET, RHODE ISLAND**

TOOLS—DIES—JIGS—FIXTURES—GAGES
Tool Engineering—(Designing)
Send us your samples or prints for quotations.
Prompt and efficient service.
PRODUCTION TOOL COMPANY
610 Sayler Ave. Knoxville 7, Tenn.

OPEN CAPACITY
6-SPINDLE NEW BRITAIN GRIDLEYS UP TO 1" DIA.
SWISS AUTOMATICS UP TO ⅝" DIA.
TURRET LATHES UP TO 1¼" DIA.
DRILL PRESSES
PRODUCTION MILLERS ASSEMBLY WORK
15 years' experience on precision screw machine products. Prompt deliveries and guaranteed work.
J. & H. SMITH MFG. CO.
5634 Broadway, New York Kingsbridge 3-2881

WANTED: PEACETIME PIECE WORK

Send your blue prints and samples for prompt quotations on work done on our wire feed screw machines (⅛" to ⅜" capacity), drill press or lathe.

UNIQUE STEEL BLOCK CO.
WAVERLY, NEW YORK

SEND B.P. FOR
MFG. COMPLETE ASSEMBLIES
Tool—Jigs—Dies
Screw Machine and Turret Lathe Work
Stampings—Gears
POSSY'S TOOL & MFG. CO.
51 Meadowbrook Buffalo 6, N. Y.

SEARCHLIGHT SECTION

Employment • BUSINESS • OPPORTUNITIES • Equipment—Used or Resale

WANTED
MACHINE DESIGNER

Exceptional opportunity for young machinery designer 30-35 years old in company established over 60 years with reputation for building high quality, labor-saving machinery. Thorough knowledge of cams and tool designing for interchangeable parts necessary. Company located in Central Connecticut. Write fully giving details of education, experience, and salary requirement.

P-523, AMERICAN MACHINIST
330 W. 42nd St., New York 18, N. Y.

WANTED

Experienced design engineer for immediate and permanent employment. By a progressive manufacturer of precision machine tools for rebuilding internal combustion motors, primarily automotive. A pioneer in the field with world wide distribution for over 25 years and located in medium sized mid-west city. If you would like to affiliate with a well-established company that is small enough so that individual merit is bound to receive just recognition, write giving complete personnel history, enclosing recent photograph. All replies confidential.

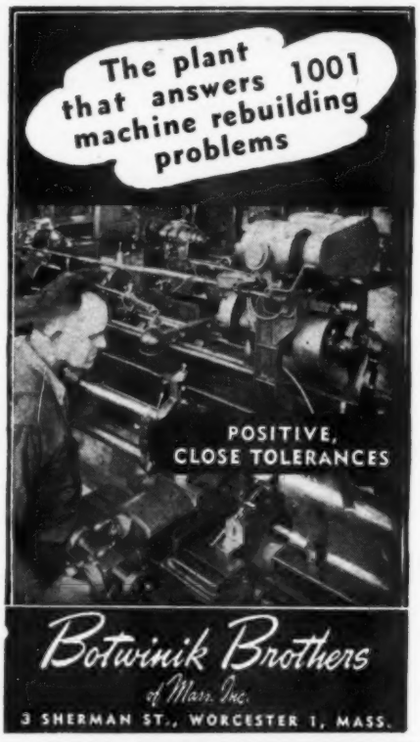
P-556, AMERICAN MACHINIST
330 WEST 42nd ST., NEW YORK 18, N. Y.

WANTED—MACHINE DESIGNER

Experienced on special or paper working machinery. Excellent opportunity for permanent position. Location Philadelphia area. Please give complete details, age, experience, etc.

P-500, AMERICAN MACHINIST
330 West 42nd St. New York 18, N. Y.

REBUILDING


The plant that answers 1001 machine rebuilding problems
POSITIVE, CLOSE TOLERANCES
Botwinik Brothers
of Mass. Inc.
3 SHERMAN ST., WORCESTER 1, MASS.

POSITIONS VACANT

WANTED: ASSISTANT Shop Superintendent with practical machine shop experience as a machine operator, knowledge of shop mathematics, layout and setup work. Requires knowledge of modern shop control, routing, operating methods, also methods of cutting metals and the supervision and direction of men. Location: Fox River Valley, Wisconsin. P-530, American Machinist, 520 N. Michigan Ave., Chicago 11, Ill.

ELECTRICAL ENGINEER: Old established company has opening for electrical engineer with an E. E. degree, and considerable experience in installation and operation of industrial machinery. Excellent future possibilities. Give complete details of personal qualifications and work history in letter of application. P-547, American Machinist, 330 W. 42 St., N.Y. 18, N.Y.

EXPERIENCED GENERAL foreman or superintendent wanted for small progressive machine tool company building drilling, tapping and boring machinery. Radius 120 miles from Cincinnati. Excellent opportunity for man who can produce results. State age, education, experience and give references. Reply confidential. P-571, American Machinist, 520 N. Michigan Ave., Chicago 11, Ill.

EMPLOYMENT SERVICE

SALARIED POSITIONS $2,500-$25,000. This thoroughly organized confidential service of thirty-six years' recognized standing and reputation carries on preliminary negotiations for supervisory technical and executive positions of the calibre indicated through a procedure individualized to each client's requirements. Retaining fee protected by refund provision. Identity covered and present position protected. Send only name and address for details. R. W. Bixby, Inc., 266 Dun Bldg., Buffalo 2, N. Y.

POSITIONS WANTED

MANAGER HEAVY machinery, plate and structural work. Production, labor relations, engineering, sales. Resourceful, leader and organizer. Top record. Best references. Engineering degree. Age 39. PW-534, American Machinist, 330 W. 42nd St., New York 18, N. Y.

(Continued on page 228)

EVERY ITEM GUARANTEED AS REPRESENTED

FALK FOR DEPENDABILITY IN REBUILT MACHINERY

AUTOMATICS

6—#61 New Britain-Gridley 6 Spindle 1⅝" cap. Automatic Screw Machines. A.C. Motor Drive, Threading Spindle.
1—1¼" Cone 4-spindle Automatic, Motor Driven, Threading Spindle.
1—#515 National Acme 1⅝" 4-spindle Automatics, complete.
2—#55 National Acme 1⅝" 4-spindle Automatics, complete.
1—#2G Brown & Sharpe Automatic.
1—#1 Brown & Sharpe Automatic, old style.

BORING MILLS

100" Niles-Bement-Pond Bor. & Turn. Mill.
3½" Bar Landis-Rochester Horizontal Boring Mill, Model #36.
#31 Lucas Horizontal Boring Mill, 3" bar.

DRILLING MACHINES

Avey, 2 & 3 spindle Prentice, 4 spindle.
Henry & Wright, 6 spindle, #2 M. T.
Woodward & Rogers, 6 spindle, #2 M. T.
Fosdick 13" Super speed 4-spindle drills.
Natco #12, 12 spindle #1 M. T.
Natco #14, Rect. head

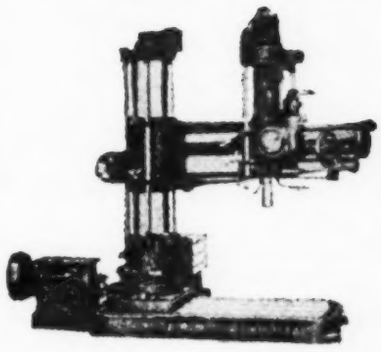
RADIAL DRILLS

3' 9" column Cincinnati-Bickford.
3' 9" col. American, S.P.D.
3' Dreses, 10" rd. col. QCG., M.D.
3' 10" Col. Fosdick
5' Arm 13" Rd. Col. Cinn. Bick, air clamp.

GRINDERS

12" No. 22 Heald Rotary Surface Grinder.
16" Persons-Arter Rotary Surface Grinder.
#4 Brown & Sharpe Universal Grinder.
#12 Greenfield Internal Hydromatic Grinder, sizematic type, complete with Tank and Pump. 15" swing, 5" hole, 4" dee.
Oliver Model 51 Drill Grinder; 1½" cap.
#2 Brown & Sharpe Surface Grinder.
#70 Heald Internal Grinder.
#60 Heald Cylinder Grinder.
#11 Brown & Sharpe Plain Cylindrical.

Blanchard Grinder #16, 30" dia. Magnetic Chuck, 25 HP 3-60-440 V. Motor.
3—#2 Cincinnati Centerless Grinder.
Pratt & Whitney Vertical Surface Grinder, 14"x36" with 10"x36" Magnetic Chuck. Ball Bearing Spindle. Perfect Condition.
#2 Cincinnati Universal Tool and Cutter



Cincinnati-Bickford 5' Arm, 13" round column with air clamp. Oil grooved, tee slotted base, side base, with plain box table with #5 Morse Taper spindle. Motor drive.

LATHES

14x6 Pratt & Whitney semi—Q.C.G.
16" Warner & Swasey Fox Brass (2).
16" Dreses Fox Brass.
26x12 Putnam Heavy Q.C.G., arr. for M.D.
#6A Potter & Johnston Automatic Chuckers; 3½" dia. hole in spindle (2).
14x6 Hendey Toolroom Lathe, G. H., M.D.
14x8 LeBlond Toolroom Lathe, cone drive.
14"x6' Hendey 12-speed geared head.
14"x102" centers Hendey Lathe, M.D.
16"x6' Rockford Tool Room Lathe, taper, collets.
16 x 8 American, Taper Attach., Motor Drive

MILLING MACHINES

#3, #4, #5 Cinn. High Power, Plain, S.P.D.
No. 0 Bickett Vertical Bench Miller.
#1-#1½-#2 Brown & Sharpe Plain Miller.
P & W 2½" Duplex Spline Miller.
Hall Planetary Thread Miller 24".
#8 Lees Bradner Thread Miller.
#1, #2, #3 Kempsmith Plain Millers.
#2½, #3 LeBlond Universal.

PLANERS

30"x30"x10' Cinn. Heavy Pattern, 2 Hds.
20"x20"x24" N.-B.-P., Planer Shaper, M.D.
24"x24"x6' Cincinnati, 2 heads, M.D.

POWER PRESS HEADQUARTERS

#4 Bliss D. C. Forging Press
200 ton A.C.F. Hydraulic Press. Bed 24"x 36", 4-post.
3—25 ton K. R. Wilson Hydraulic Presses.
Beck Duplex Embossing Press.
75 ton H.P.M. 2 post, Hydraulic Press.
#1 Bliss Straight Side, double action, Cam Press. Will draw and lift out 2¾".

SHAPERS AND GEAR CUTTERS

12" Schuchart & Schutte Gear Hobber.
#1 Adams Gear Hobbers, Belt driven (3).
16" Gould and Eberhardt
21" Smith & Mills B.G. Helical Gears.
24" Gould and Eberhardt, Motor Drive

SHEARS & METAL CUTTING MACHINERY

Lennox Splitting Shear, ¾" cap.; 8' throat.
Lennox Bevel Shear, ¾" cap.
Gould & Eberhardt Slitting Shear, 10 ga.
Bertsch 3"x36" Geared Slip Roll Former.
Niagara 48" Roller Leveller, 6 Rolls.

MISCELLANEOUS

Waterbury-Farrel Cold Header, double stroke, open dia, ½" cap. & 6".
Manville Cold Header, single stroke, solid die, 3/16" cap.

Lacquer Heater Tank with acquistat. 150 ga.
Heat Treating Furnaces for the tool room.
Hydraulic Pumps—Hele Shaw, Racine, Oil Gear, Motor Driven.
Blake and Knowles 12x2x12 Simplex Type, Hydraulic Steam Pump, 2000 lbs. pressure with 80 to 125 lbs. steam, delivers 9 gallons per minute.
No. 7B High Speed Riveting Hammer, cap. ¾" to 1½. New this year.
#5B High Speed Riveting Hammer.

BUY FROM STOCK
Telephone
MAIN 6347-6348

FALK
MACHINERY COMPANY
Machinery Merchants

18 WARD ST.
ROCHESTER 5
N. Y.

POSITIONS WANTED

(Continued from page 226)

WORKS MANAGER, plant manager general supt. Technically trained mechanical and industrial engineer. 24 years manufacturing light and heavy precision machine tools, diesel engine and aviation specialties, electric motor and equipment for leading companies, 8 years engineering capacities. 16 years in charge of manufacturing. An inherent mechanic and engineer experienced in using modern methods, machines, tools, and systems in all manufacturing departments from purchase of material to shipment of product. Jobbing lots and line production. Good records for results in increasing production, reducing costs, efficient organizations and handling of labor relations. 44 years old. Immediately available. PW-541, American Machinist, 330 W. 42nd St., New York 18, N. Y.

MECHANICAL ENGINEER, age 41, with special machines, tools and dies designing experience, method engineer, research and development engineer with proved supervisory ability, desires supervisory position with a progressive company. PW-573, American Amachinist 330 West 42nd St., New York 18, N. Y.

DESIGN ENGINEER: 20 years experience with large electrical manufacturer in design and development of direct current generators and motors for gas-electric and diesel electric traction applications. Would change to same kind of work with diesel-electric locomotive builder who desires to build his own electrical rotating apparatus. Minimum salary $7800. PW-574, American Machinist, 330 W. 42nd St., N. Y. 18, N. Y.

EX-SERVICE MAN, 25, mechanical engineering background, wants future in tool, machine designing. Served apprenticeship as tool maker, year engineering college. PW-575, American Machinist, 330 West 42nd St., New York 18,

MACHINE TOOL Engineer would like to act as European sales engineer for important machine tool firm or combine personal market acquaintance, languages, references. PW-564, American Machinist, 330 W. 42nd St., New York 18, N. Y.

PRODUCTION ENGINEER: Well grounded in modern industrial practices for economical manufacture and assembly of high production precision assemblies, including design, tooling, methods and standards. Good background includes University training, toolmaking, plant superintendency and process engineering. Age 34. Only position of considerable responsibility considered. W-559, American Machinist, 520 N. Michigan Ave., Chicago 11, Ill.

PATENT ATTORNEY

PATENTS, COPYRIGHTS, Booklet, "General Information concerning inventions and patents" and "Free Schedule" sent without obligation. Established 1915. Lancaster, Allwine & Rommel, Suite 453, 815-15th St., N.W., Washington 5, D. C.

SELLING OPPORTUNITIES OFFERED

EXPERIENCED MACHINE tool sales engineer wanted for New York territory. Please write giving complete qualifications and history in first letter. All correspondence in absolute confidence. SW-576, American Machinist, 330 West 42nd St., New York 18, N. Y.

EXPERIENCED MACHINE tool salesman for Middle West with progressive sales company, well established lines. State age, education, experience, salary required. SW-572, American Machinist, 520 N. Michigan Ave., Chicago 11, Ill.

SELLING OPPORTUNITY WANTED

MANUFACTURERS AGENT: Philadelphia. Desires additional line. Good following in metal working industry (established 10 years) straight commission, protected territory basis. RA-577, American Machinist, 330 West 42nd Street, New York 18, N. Y.

FIRM OF Engineers in Northern Ireland, having own sales organization, are prepared to act as agents and stockists for manufacturers of engineering and electrical goods. Service department will also be placed at the disposal of principals. RA-578, American Machinist, 330 W. 42nd St., New York 18, N. Y.

TOOL DESIGNERS of dies, jigs, fixtures, plastic, and die cast molds, prompt quotation based on your drawings and samples.

ARNKURT ASSOCIATE ENGINEERS
82 BEAVER ST. NEW YORK 5, N. Y.
Tel. HAnover 2-7135

PLANT SUPERINTENDENT

For well rated Chicago company employing 1200. Must have punch press, screw machine and general assembly experience on small, relatively complicated mechanical devices. Will pay top salary and therefore interested only in high grade man with proven record. State age, education, experience, salary expected. Address

P-568, AMERICAN MACHINIST
520 N. Michigan Ave., Chicago 11, Ill.

MACHINE TOOL EXPERT

Wanted as assistant to Chief Engineer of important machine tool import-export house with headquarters in New York and affiliations throughout the world. College or university graduate with knowledge of foreign languages preferred. Must be familiar with modern toolroom, production, measuring and checking methods. Apply with details of education, past experience, family background, references, to

P-570, AMERICAN MACHINIST
330 W. 42nd St., New York 18, N. Y.

WANTED
OPERATING ENGINEER

Capable of taking charge of mechanical equipment including power plant in sugar factory in West Indies. Knowledge of Spanish desirable but not necessary. Give full details of education and experience and salary required.

P-566, AMERICAN MACHINIST
330 West 42nd St. New York 18, N. Y.

WANTED—MASTER MECHANIC

Capable of taking charge machine shop and foundry and steam locomotive repair shops connected with sugar factory in West Indies. Knowledge of Spanish desirable but not necessary. Give full details of education and experience and salary required.

P-567, AMERICAN MACHINIST
330 West 42nd Street New York 18, N. Y.

WANTED

Foreman for small Machine Shop located in Northwestern Pennsylvania. Must have had Machine Tool experience. Write giving age, experience, starting salary expected and when available.

P-527, AMERICAN MACHINIST
330 West 42nd St., New York 18, N. Y.

WANTED
MANUFACTURERS' AGENT

Manufacturer of standard carbide and special carbide and high speed cutting tools—milling cutters, reamers, counterbores, form tools—has territories open.

RW-569, AMERICAN MACHINIST
330 W. 42nd Street New York 18, N. Y.

REPRESENTATION

An outstanding progressive Manufacturers Representative, covering the New England territory with competent engineers, is desirous of adding proven products to their present line of machine shop equipment.

RA-580, AMERICAN MACHINIST
330 W. 42nd St., New York 18, N. Y.

WANTED
SALES ENGINEERS

To represent a modern gear manufacturing plant. Must have a degree in mechanical engineering as well as extensive selling experience in the gear industry. Write full details including name of university and year graduated; names and addresses of former employers; salary and territory desired and other pertinent details.

SW-410, AMERICAN MACHINIST
330 W. 42nd St., New York 18, N. Y.

NEW PRODUCTS WANTED

Our client, an established manufacturer, wants new products or new ideas that might be developed into new products.

Experienced in steel casting, welding and machining in any combination—large sizes, great precision.

Selling industrial and manufacturing markets.

Please write Dept. 13. Communications in confidence. We are fully compensated by our client.

CHARLES H. WELLING & CO., INC.
52 Vanderbilt Avenue
New York 17, N. Y.
New Products—New Process

WANTED

CAM MILLING MACHINES
16"—20" or 24" Table

W-579, AMERICAN MACHINIST
330 WEST 42nd ST., NEW YORK 18, N. Y.

WANTED

Automatic Brown & Sharpe Screw Machine, 2-G, 1½" capacity. State Serial Number, Condition, Price.

DeJUR-AMSCO CORPORATION
LONG ISLAND CITY 1, NEW YORK

FOR SALE

2 #4 Warner & Swasey Turret Lathes complete with large amount of tooling. Like new, run 30 days, cost $5667, and $5402. Advise if interested. Also numerous other machine tools.

DEXTER MANUFACTURING CORP.
Narrowsburg, N. Y.

48"x48"x16' Sellers Planer, 4 heads
Model C, Becker Vertical Milling Machine (1942)
8"x120" Le-Swing Lathe, 1942
Pratt & Whitney Production Milling Machines
Kingsbury Multiple Spindle Drilling & Tapping Machine

CONTINENTAL SALVAGE & MACHY. CORP.
334 Union Bldg. 1836 Euclid Ave., Cleveland 15, O.

Additional Equipment Wanted Advertisement on page 237

FOR IMMEDIATE DELIVERY

650 MACHINE TOOLS OF LATEST TYPE AND DESIGN

BUILT AFTER 1941 - - TIMKEN BEARING

LATHES — ENGINE

All Are Geared Head, Motor Driven

SEBASTIAN "H" 12"x4' bed—Timken bearing
SEBASTIAN "H" 16"x8' bed—Timken bearing
LEBLOND 16"x54" centers—Timken bearing
LODGE & SHIPLEY 16"x54" centers—Timken bearing
PRATT & WHITNEY "C" 16:x78: centers—Timken bearing
MONARCH 16"x102" centers, 16-speed—Timken bearing
LEHMAN 18"x6' bed—geared head
LODGE & SHIPLEY 18"x18' bed—geared head
SPRINGFIELD Precision—18"x30" centers—Timken bearing
AXELSON 18"x45" centers, 24 speed—Timken bearing
AVELSON 18"x69" centers, 24 speed—Timken bearing
PRATT & WHITNEY 20"x48" centers—geared head
LEHMAN 24x18'—geared head
LODGE & SHIPLEY 27x28'—geared head
AXELSON 20"x115" centers, 24 speed—Timken bearing
AXELSON 24"x72" centers, 24 speed—Timken bearing
AXELSON 24"x120" centers, 24 speed—Timken bearing
LODGE & SHIPLEY 27"x20' bed
AMERICAN 27"x96"—Timken bearing
LEBLOND 27"x96"—Timken bearing
AXELSON 32"x120" centers, 24 speed—Timken bearing
AMERICAN 36"x15' bed—geared head
AMERICAN 36"x22' bed
BRIDGEFORD 36"x32' bed—2 carriages
BRIDGEFORD 36"x44' bed—2 carriages
NILES 36"x25' centers—2 carriages; PRT—Timken bearing
BRIDGEFORD 42"x35" bed—2 carriages
AMERICAN 42"x40" bed—2 carriages
LEBLOND 48"x22" centers; 48"x34" centers; 48"x40" centers—2 carriages—Timken bearing—PRT

LATHES — TURRET

JONES & LAMSON #5 Univ. Ram Type; Timken bearing; chucking
BARDONS & OLIVER #5 Univ.; Timken bearing; chucking
BARDONS & OLIVER #7 Univ.; Timken bearing; chucking
WARNER & SWASEY #3A Hollow Hex. Univ.; Timken bearing; chucking
WARNER & SWASEY #4A Univ. Hollow Hex.; Timken bearing
CINCINNATI ACME Universal—Timken bearing
FOSTER #2F Univ. Fastermatic; Timken bearing
FOSTER #3F Univ. Fastermatic; Timken bearing
POTTER & JOHNSTON #5D Power-Flex Auto. Chucking & Turning; Timken bearing

DRILL PRESSES

FOSDICK #4 BM, 1 spdle; 8" overhang
FOSDICK #5 BM, 1 spdle; 12" overhang
AMERICAN 2' Plain Radial
DRESES 3½' Plain Radial; box table

SAWS

MARVEL #6, 6"x6", ball bearing, Hack
MARVEL #9, 10x10", ball bearing, Hack
PEERLESS 10"x10" Universal Hack
PEERLESS 14"x14" Hack
MARVEL #18 Hydraulic Roll Stroke Hack, 18x18"
CAMPBELL #401 Cutamatic Wet Abrasive Cutting Machine

GRINDERS

CINCINNATI #3 Centerless; Timken bearing
CINCINNATI #4 Centerless; Timken bearing
CINCINNATI 6"x30" Plain Hydraulic; Model EA
NORTON 6"x18" Hydraulic Surface
ABRASIVE #3B Surface
PRATT & WHITNEY 14"x60" Vertical Surface
BLANCHARD #16 Vertical Surface
JONES & LAMSON 6"x36" Automatic Thread; Timken bearing
BROWN & SHARPE #13 Universal

SHAPERS

CINCINNATI 16" rapid traverse; Plain and Universal
GOULD & EBERHARDT 24"
COLUMBIA 24"
AMERICAN 24"
GOULD & EBERHARDT 24"
COLUMBIA 24"
CINCINNATI 24" power rapid traverse
CINCINNATI 32" rapid traverse Universal

MILLING MACHINES

BROWN & SHARPE #2B Plain—Timken bearing
BROWN & SHARPE #3A Univ.—Timken bearing
BROWN & SHARPE #2 Vertical—Timken bearing
KENT-OWENS #1M Hand; motor drive; ball bearing

PLANERS

LIBERTY 24"x24"x8'; 1 head on cross rail, 1 side head, A.C Vari. Voltage Drive

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NILES 42", 2 swivel heads, power rapid traverse
NILES 53", 2 swivel head, power rapid traverse

MISCELLANEOUS

BRINNELL Automatic Direct Reading Hardness Testing Machine
JONES & LAMSON A-2108-C Pedestal Comparator & Measuring Machine, 14½" dia.
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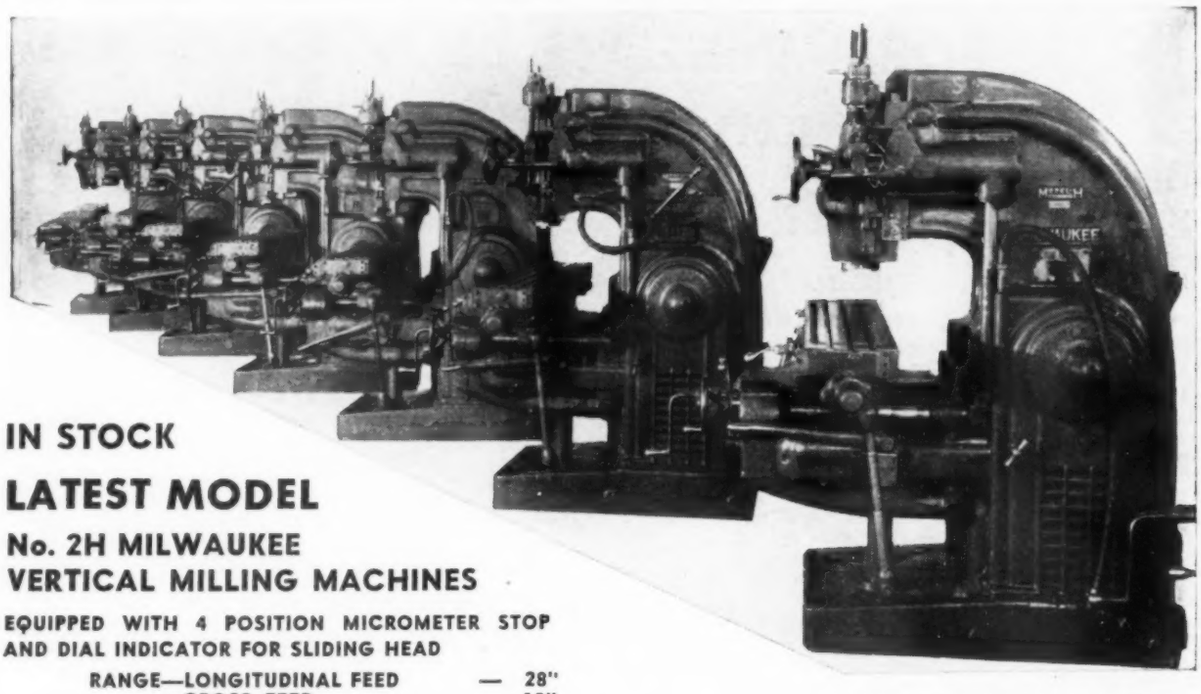

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1—3½ Cincinnati Gilbert Horizontal Boring Mill New in 1941.
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1—10" x 72" Norton Type C Plain Hydraulic Grinders, A.C. Motor Drive.
1—#2-20 Kent Owens Hydraulic Milling Machines, A.C. Motor.
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2—#1-8 Kent Owens Hydraulic Millers. New 1941. drive.
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42' Niles 2 Head Boring Mill, reasonably priced.
36" Bullard New Era Vertical Turret Lathe, S.P.D.
61" Bullard Maximill, 2 heads, Power Rapid Traverse.
10' Cincinnati Boring Mill, 2 heads, Excellent.

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27" x 16' Lodge & Shipley Geared Head, A.C. M.D. Taper
36" x 30' Lodge & Shipley Geared Head, Two Carriages, Q C
16" x 8' Reed Prentice Timken Bearings. A.C. M.D. Taper
14" x 6' Hendey Geared Head, A.C.M.D. Taper.
24" x 16' American Grd. Head, S.P.D.
36" x 16' American Grd. Head, 16 speed.
36" x 36' American Geared Head, 2 carriages.
24" x 20' Boye & Emmes 3 S.C.D. D.B.G. Motorized.
24"x20' American Bowl Head, 3 S.C.D. D.B.G.

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#4 Cincinnati High Power, A.C. M.D. Rapid Traverse, Vertical.
#5 Cincinnati Rect. Overarm, Rapid Traverse, S.P.D.
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16CP16 Bryant Internal Grinders, A.C.M.D.
Pratt & Whitney 2 wheel, Helical Gear Grinders.

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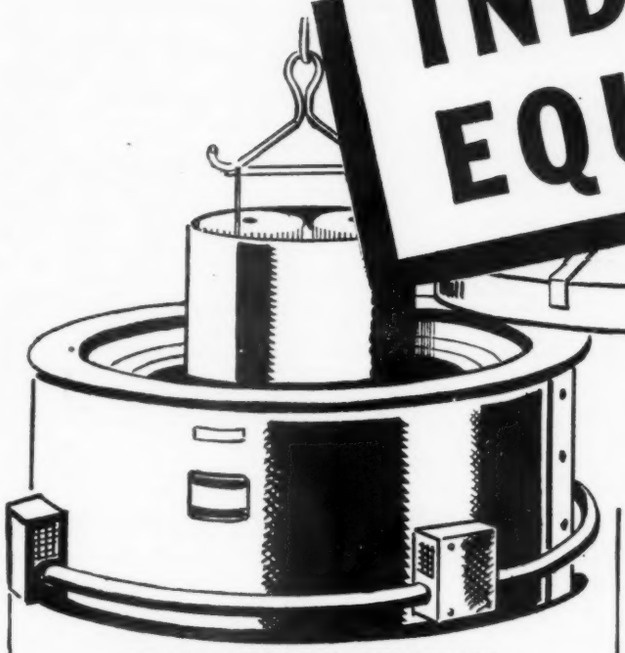

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1. Submit in writing your requirements for machine tools and industrial equipment to us now.
2. Send a typewritten list to your nearest office listed below.
3. Make your descriptions brief, one line if possible, clearly grouping various types of equipment you need.

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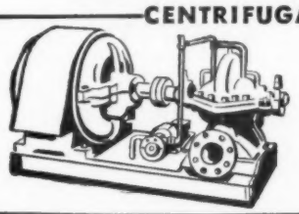

Available at most agencies in sizes 1½" to 6", complete with prime mover, usually electric motor driven.

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No. 3B Milwaukee Plain, m.d.
No. 4 LeBlonde Plain, c.d.
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3" Bar Universal TRI-WAY Horizontal Boring Mill with 32" x 58" table. P.R.T.

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72" COLBURN vertical, 2 swivel heads, all geared speeds, Power Rapid Traverse.

100" NILES-BEMENT-POND Vertical, 2 swiveling heads, Power Rapid Traverse.

120" BETTS Heavy Vertical, 2 swiveling heads, Power Rapid Traverse, AC or DC.

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42" x 26" x 12' INGERSOLL Planer Miller, 4 heads, M.D.

No. 4 CINCINNATI High Power Plain, Power rapid traverse table 16½" x 64". Single pulley belt drive or AC or DC.

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No. 5 CINCINNATI Plain Rectangular overarm.

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20" x 20' AMERICAN Geared Head Engine Lathe.

36" x 30' LODGE AND SHIPLEY 18 speed selective geared head screw cutting engine lathe, 2 carriages. AC or DC motor drive.

42" x 36" PUTNAM Geared Head, 25' between centers. Quick change gear box.

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4' AMERICAN Plain triple purpose enclosed head drill, tapping attachment.

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6' AMERICAN Triple purpose, plain radial, motor on arm.

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24" x 20' Centers NORTON Plain, Cylindrical, individual motor drive to work spindle, wheel spindle and table.

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36" x 36" x 12' CINCINNATI Standard Planer, 2 heads on rail, power elevation to rail, AC or DC motor drive.

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21" & 24" Cincinnati upright

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Nos. 16HS & 18H Gould & Eberhardt hobbers
Nos. 7 & 61 Fellows shapers
Nos. 1 & 5A Lees Bradner hobbers
11" Gleason bevel generator
18" Gleason testers & lappers
No. 3 Barber Colman hob grinder

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16", No. 10 Blanchard surface
18" Arter rotary surface
14" Pratt & Whitney vert. surface
6"x18" Norton hydr. surface
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No. 72A3 Heald Sizematic internal
53" & 72" Gardner horizontal disc
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14"x18" Monarch Magnamatic
14"x19" Fay automatic
15"x22½" Sundstrand auto. stub.
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No. 35 Ohio universal
No. 2 Cincinnati dial type vertical
No. 2 Brown & Sharpe vertical
No. 2½B Milwaukee vertical
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30" x 48" Newton rotary

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14"x6' American Geared Head, m.d., taper, collets
14"x6' Pratt & Whitney, cone
14"x8' Pratt & Whitney, cone, motorized
16"x6' Lodge & Shipley Selective Head, m.d., taper
16"x8' American, cone, taper
16"x8' Cincinnati, m.d., taper, geared head, latest type
16"x10' Hendey Geared Head, m.d., taper
16"x12' Lodge & Shipley Patent Head, m.d.
17"x6' LeBlond Geared Head, m.d., taper, relieving attach.
18"x30" centers Hendey Geared Head, m.d. in base, latest type
18"x6' Mueller, cone
18"x7' Hendey Geared Head, m.d., taper
18"x8' Hendey, yoke head
18"x8' Lodge & Shipley, cone, motorized
18"x8' Sidney Monotrol, m.d. in base
18"x8' Rockford, cone
18"x102" centers Lodge & Shipley Selec. Head, m.d. in base, latest
18"x126" centers Lodge & Shipley Selec. Head, m.d. in base, latest
18"x120" centers Monarch, m.d. in base, taper
18"x14' Hendey Yoke Head, m.d.
22"x16' centers American 100 H.P. Input Super Lathe, m.d.
23"x12' LeBlond Geared Head, m.d., taper
24"x72" centers Lodge & Shipley Selec. Head, m.d., taper, latest
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25" raised to swing 32"x12' LeBlond, cone
27"x16' LeBlond, cone
30"x12'6" Niles-Bement-Pond Geared Head, m.d., taper
30"x13'6" Niles-Bement-Pond Geared Head, m.d.
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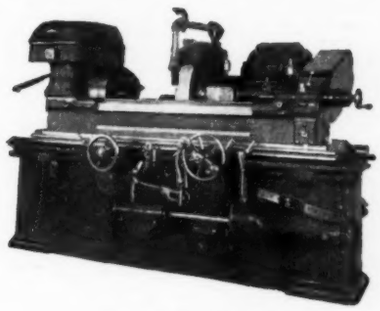

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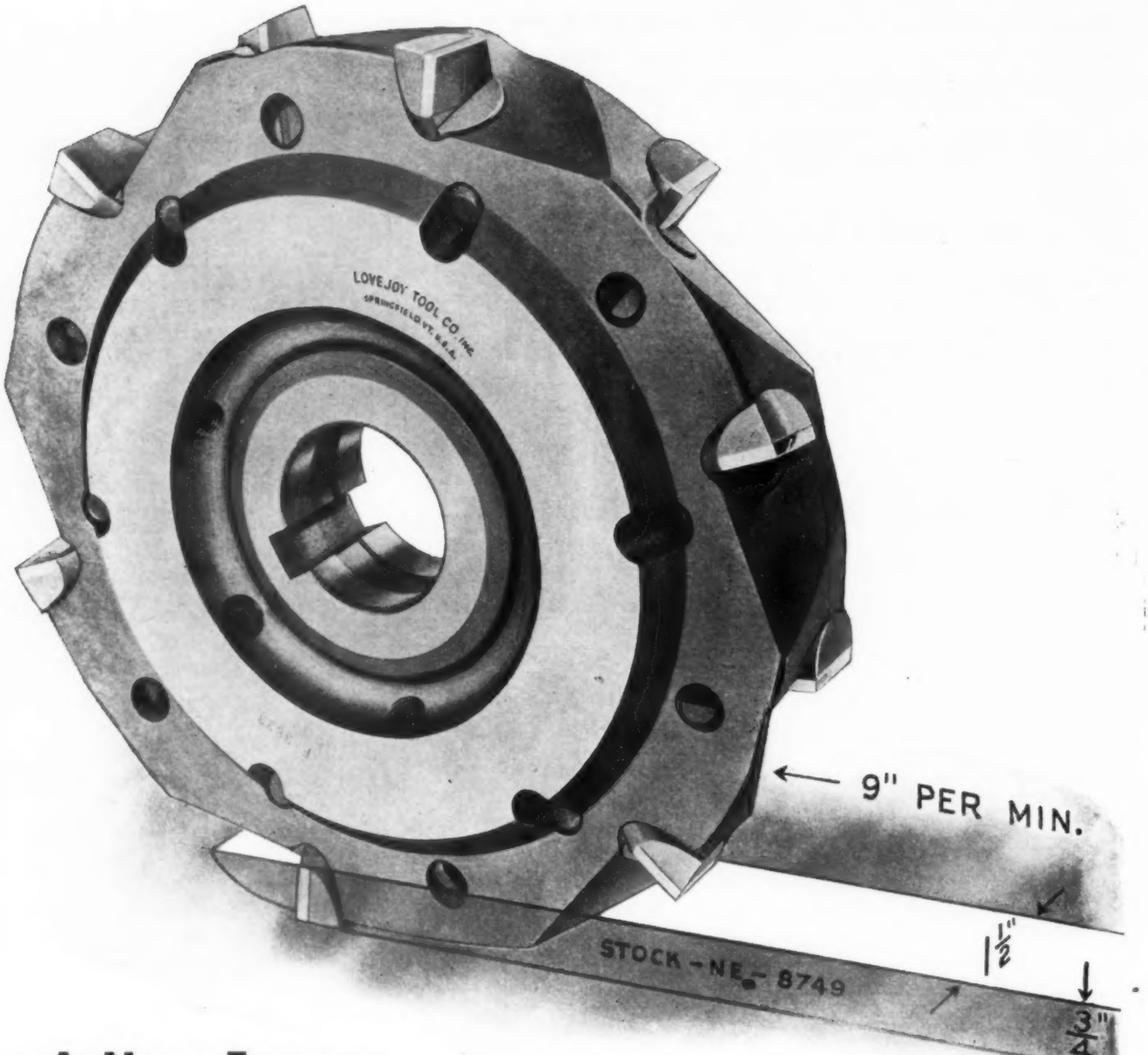

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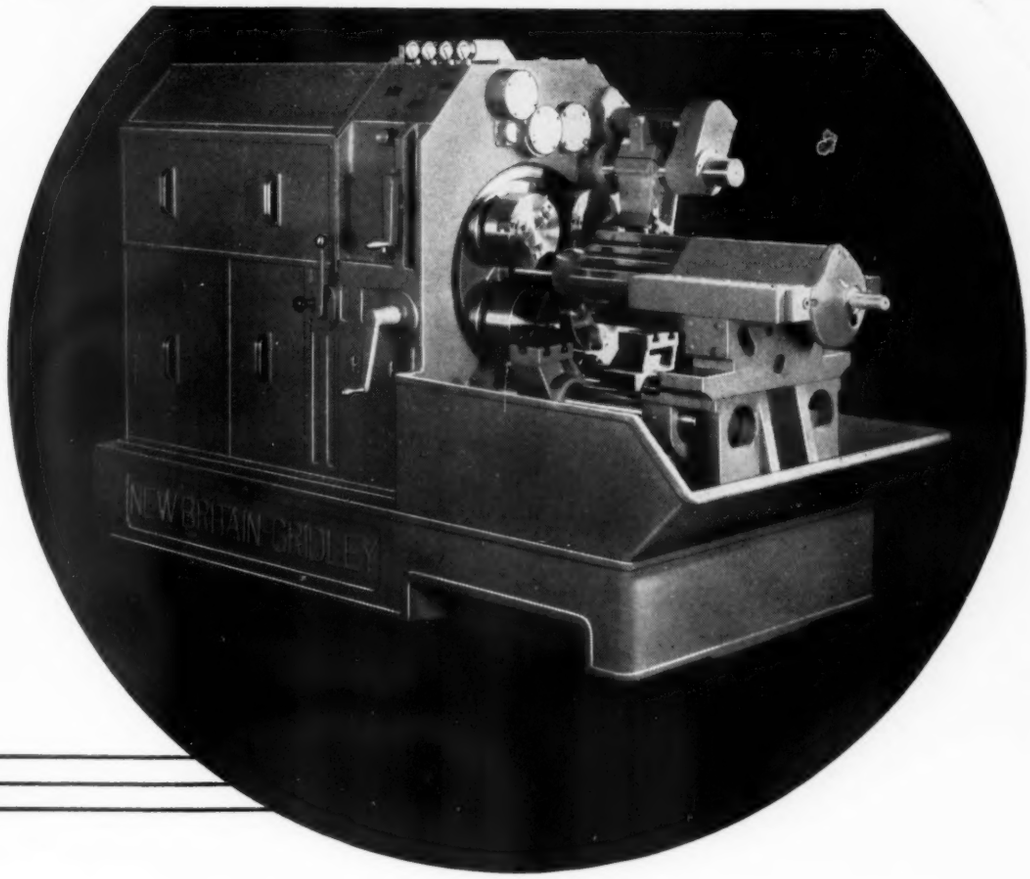

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